Water Temperature and Transparency in Dauphin Lake, Manitoba

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by

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This is the 3rd Manuscript Report
from the Central and Arctic Region, Winnipeg

PREFACE

This report represents research completed as part of an M.Sc. degree at the University of Manitoba, Department of Zoology in cooperation with the Canada Department of Fisheries and Oceans, Fisheries Rehabilitation Research Project.

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ABSTRACT

Schaap, P.R.H. 1987. Water temperature and transparency in Dauphin Lake, Manitoba. Can. Manuscr. Rep. Fish. Aquat. Sci. 1920: v + 34 p.

Water temperatures and transparencies (secchi depths) in Dauphin Lake, Manitoba were measured during the open water season of 1984 and 1985. Maximum measured inshore temperatures were 32.5°C and 27.0°C in 1984 and 1985, respectively. Diurnal temperature fluctuation decreased with increasing depth. Maximum daily fluctuation in 1984 was 14.5°C at 25 cm water depth. In 1984 water temperatures measured on the lake bottom at 25, 50, and 100 cm depths did not differ significantly. Water temperatures measured on the lake bottom at 50 and 100 cm in 1985 were significantly different. Mean daily temperatures were significantly warmer in 1984 than 1985. Secchi disc measurements ranged from 14-55 cm over both summers. Daily variation in secchi depth measurements was high, peaking at 34 cm on June 17, 1984. A mean secchi depth of 10 cm occurred in the fall of 1985.

The large surface area, low mean depth and low-lying topography surrounding Dauphin Lake facilitates thorough wind-induced mixing of the water column. Water temperatures are usually homogeneous and are influenced by atmospheric temperatures. Wind-induced mixing is responsible for the resuspension of particulates in the water column and the resulting low transparencies.

Key words: water temperature; water transparency.

RÉSUMÉ

Schaap, P.R.H. 1987. Water temperature and transparency in Dauphin Lake, Manitoba. Can. Manuscr. Rep. Fish. Aquat. Sci. 1920: v + 34 p.

On a mesuré, en 1984 et en 1985, la température et la transparence (au moyen de disques de Secchi) de l'eau du lac Dauphin, au Manitoba, pendant la période où la surface du lac était libre de glace. Les températures maximales enregistrées près des rives étaient respectivement de 32,5°C et de 27,0°C en 1984 et en 1985. La variation diurne diminuait en raison directe de l'augmentation de la profondeur. En 1984, la variation journalière moyenne a été de 14,5°C à 25 cm de profondeur. Cette année-là, les températures mesurées au fond du lac à 25, 50 et 100 cm de profondeur ne variaient pas sensiblement. La température de l'eau mesurée sur le fond du lac à 50 et à 100 cm en 1985 présentait toutefois d'importantes différences. Les températures quotidiennes moyennes étaient beaucoup plus élevée en 1984 qu'en 1985. Les mesures de la transparence au disque de Secchi s'établissaient entre 14 à 55 cm au cours des deux étés. La variation quotidienne de ces mesures était élevée, le maximum étant de 34 cm enregistré le 17 juin 1984. Au cours de l'automne 1985, la transparence moyenne mesurée au disque de Secchi était de 10 cm.

En raison de la grande surface du lac Dauphin, de la faible profondeur moyenne et du terrain plat qui l'entoure, la colonne d'eau est bien mélangée par le vent. La température de l'eau est habituellement homogène et subit l'influence de la température atmosphérique. Comme l'eau est brassée par le vent, les particules dans la colonne d'eau sont remises en suspension, ce qui explique la transparence peu élevée de l'eau.

Mots-clés: température de l'eau; transparence de l'eau.

INTRODUCTION

Dauphin Lake, Manitoba (51°17'N, 99°48'W) is the site of a pilot project run by the Canada Department of Fisheries and Oceans under a cooperative agreement with the Manitoba Department of Natural Resources to assess the feasibility of rehabilitating the depleted walleye, Stizostedion vitreum vitreum (Mitchill), population in the lake. Studies of fish and invertebrates on the lake and several of its tributaries have been in progress since 1982 (eg. Babaluk et al. 1984; Heise 1985). Hydrological analysis in parts of the surrounding watershed has been ongoing for twenty-nine years (R. Newbury, Department of Fisheries and Oceans, Winnipeg, MB, personal communication). Lake water chemistry has also been examined (J. Babaluk and M. Friesen, Department of Fisheries and Oceans, Winnipeg, MB, personal communication).

Water temperature has important physical and chemical ramifications in the aquatic environment, affecting production, decomposition and behavior of biota (Wetzel 1983). Water transparency is also an important determinant of biotic distribution and behavior (eg. Dadswell et al. 1983). Together they may affect fish community and species ecology and are useful parameters to measure in fisheries ecology investigations. During the years 1984 and 1985 numerous ecological and population parameters of fish and invertebrates were being measured on Dauphin Lake which were potentially sensitive to temperature and water transparency.

This report documents summer water temperatures and water transparency measurements in Dauphin Lake for 1984 and 1985. It augments other temperature and transparency data by providing an analysis of daily and seasonal variability. Finally, some implications of water temperature and transparency to fish are addressed.

METHODS

CHARACTERISTICS OF DAUPHIN LAKE

Dauphin Lake is located in west-central Manitoba. It has a surface area of 522 km^2 and a mean and maximum depth of 2.1 and 3.5 m, respectively (Fig. 1a, inset). Lake sediments are dominated by silty-clay and clayey-silt (Heise 1985). Further description of the lake and drainage basin is given by Babaluk et al. (1984). Stations monitored for water temperature and transparency are shown in Figure 1b.

WATER TEMPERATURE MONITORING

Water temperatures were monitored in Dauphin Lake from late spring to mid fall in 1984 and 1985 (Table 1). Calibrated 7-day continuous-recording Weksler® temperature recorders (Model #06MNL) were mounted on wooden supports. Temperature probes were strapped to the post and positioned just above the lake bottom in depths of 25, 50 and 100 cm in 1984 and 50 and 100 cm in 1985. On several occasions the temperature recorders were damaged by storms, resulting in periodic gaps in recording. Daily mean temperatures were calculated as the average of the daily maximum and minimum measurements. Daily mean temperatures were statistically compared by paired t-tests.

Offshore surface temperatures were monitored every two weeks in both years during trawling excursions. Surface temperatures were taken from a boat with a hand-held thermometer at convenient locations within each of 21 trawling areas (Fig. 1b). In 1985, inshore surface temperatures were measured every two weeks at eight stations (Fig. 1b) using a hand-held thermometer.

Meteorological records for the area used to explain between-year water temperature differences were obtained from the Canada Department of the Environment.

WATER TRANSPARENCY MONITORING

Water transparency measurements were made from late spring (May 30) to mid-summer (August 12) in 1984 and late spring (May 16) to early fall (September 28) in 1985. Measurements were made concurrently with offshore surface temperature measurements, described earlier. Transparency was recorded as the average depth at which a standard 20 cm diameter secchi disc disappeared from view, then reappeared.

Light transmission in Dauphin Lake was measured in late summer, 1985 for a range of secchi depths. A LI-COR® quantum sensor (Model #LI-192SB) and LI-COR® photometer (Model #LI-185B) were used to measure light transmission.

RESULTS

WATER TEMPERATURE

Dauphin Lake water temperatures, measured by continuous-recording thermometers, are given in Appendices 1 and 2. Water temperatures monitored at three depths during the summer of 1984 did not differ significantly ($p<0.05$). Maximum measured temperatures at each depth were 32.5°C (25 cm), 31.5°C (50 cm) and 29.5°C (100 cm), all recorded on August 4, 1984. In 1985, a significant difference ($p<0.05$) did occur between the 50 and 100 cm depths monitored. Maximum temperatures in 1985 were 27.0°C at 50 cm (July 5) and 24.5°C at 100 cm (August 5). Figures 2 and 3 summarize measurements at the 50 and 100 cm stations for 1984 and 1985, respectively. Mean daily temperatures in 1984 were significantly warmer ($p<0.05$) than in 1985 at both depths. Water depths remained constant throughout both summers except during periods of high winds when surface seiches occurred.

The diurnal variation in mean daily water temperature is a function of depth. Temperature fluctuation decreased with increasing depth (25 cm>50 cm>100 cm) (Fig. 4). At 25 cm diurnal variation in mean daily water temperature frequently exceeded 8.0°C and peaked at 14.5°C on

August 23. At 100 cm maximum diurnal variation was 8.0°C (July 17) but rarely exceeded 4.0°C.

Offshore and inshore surface water temperatures are given in Appendices 3 and 4, respectively. Mean offshore surface temperatures closely approximated mean air temperatures in both years (Table 2). Maximum measured offshore surface water temperature occurred on July 10 in 1984 (25.0°C) and on July 8 in 1985 (23.0°C). No statistical comparison was made between years for offshore surface water temperatures since collection dates were different. Offshore surface temperatures were similar to those recorded at the 50 cm inshore site in their respective years. Inshore surface water temperatures also approximated air temperature. The maximum measured inshore surface water temperature was 25.0°C (July 3). Inshore temperatures did not completely follow temperatures observed at the 50 cm or 100 cm depth but fluctuated between the two.

Meteorological records for the area document air temperature (Table 3) and sunshine and degree-day (Table 4) differences between 1984 and 1985. Although monthly mean air temperatures in 1984 were below "normal" (the 30 year average, 1951-1980 (Canada Department of the Environment 1986)) for May and September, mean air temperatures during the summer months nearly all exceeded "normal" values. In 1985, only mean air temperatures in May were above "normal". Similar trends occurred for hours of sunshine and the accumulated number of degrees above a daily mean of 10.0°C (degree-days), with the summer months of 1984 being sunnier and warmer than in 1985.

WATER TRANSPARENCY

Summer secchi depths ranged from 15 to 55 cm in 1984 and from 14 to 45 cm in 1985 (Appendix 3). Water transparency measurements within sampling dates were variable in both 1984 (Fig. 5) and 1985 (Fig. 6). Maximum daily variation occurred on June 17 (34 cm) in 1984 and July 8 and 24 (25 cm) in 1985. Daily variation in secchi depth was greater than 20 cm on four dates in 1984. In 1985, only the two dates previously mentioned had daily secchi measurements which varied by more than 20 cm. Mean daily secchi depths reached a maximum of 43 cm on July 27, 1984, and 30 cm on July 24, 1985 (Table 2). Secchi depths measured on September 28, 1985 (fall) were all 10 cm.

Light transmission measurements revealed that 1% of surface light penetrated to 25, 60 and over 125 cm at secchi depths of 10, 23 and 33 cm, respectively (Fig. 7).

DISCUSSION

Dauphin Lake water temperatures and transparencies are extremely variable. Lake basin morphometry and sediment characteristics are largely responsible. The large lake surface area (522 km^2), shallow mean depth (2.1 m) and flat topography surrounding Dauphin Lake frequently results in complete mixing of the water mass by wind, which in turn allows rapid heat transfer and suspension of sediments. The extreme and variable characteristics of water temperature and transparency render Dauphin Lake unique and influence the ecology of the fish community.

WATER TEMPERATURE

Climatological conditions have a regulating effect on lake water temperatures and appear important in explaining the significantly warmer water temperatues of 1984 as compared to 1985. Meteorological records document the warmer air temperatures of 1984. Summer months were warmer than "normal", particularly the month of August. Monthly sunshine and calculated degree-day summaries for 1984 indicate a similar trend. Some implications of these temperature differences on fisheries are presented later.

Mean daily temperatures measured at three depths in 1984 did not differ significantly ($p<0.05$). Frequent wind-induced vertical mixing of the water column is probably responsible for the similar temperatures obtained in 1984. In 1985, however, a significant difference ($p<0.05$) did occur between mean daily temperatures measured at 50 and 100 cm which is difficult to explain. The major temperature differences between these depths in 1985 occurred in the month of August. On 22 of 26 days monitored at both depths, the mean daily temperature at the 50 cm station was warmer than the 100 cm monitoring station, suggesting stratification. Wind-induced mixing should have occurred as the average wind speed during the month of August was 14.2 $km \cdot h^{-1}$ (Canada Department of the Environment 1986), similar to other summer months. In August 1984, the average monthly wind speed was 14.3 $km \cdot h^{-1}$ (Canada Department of the Environment 1985), and inshore temperatures were homogeneous at the three depths monitored. In both years prevailing winds during August were from the west (Canada Department of the Environment 1985, 1986). Although average monthly wind speeds and directions were similar, daily wind events between the two years could have been very different and could therefore account for the observed differences in mean daily temperature.

Diurnal temperature fluctuation in the shallow inshore waters is high due to the basin structure of Dauphin Lake. The magnitude of this fluctuation decreased with increasing depth. Large areas of shallow water extend far from shore and are subjected to diurnally fluctuating atmospheric temperatures. The large surface:volume ratio (522:1, J. Babaluk, personal communication) results in rapid heat transfer and subsequent regulation of diurnal water temperature by atmospheric temperature.

Offshore surface water temperatures followed mean air temperature measurements closely and were similar to mean daily measurements recorded at the 50 cm depth. The parallel to temperatures at 50 cm probably represents the mixing of warmer surface waters with the cooler

water temperatures below this depth. Presumably, offshore surface waters would be more susceptible to mixing than the somewhat protected inshore waters of the lake. Inshore surface water temperatures also approximated air temperatures, however they did not completely follow those measured at 50 or 100 cm. As these inshore temperatures were obtained in the shallow waters immediately adjacent to shore, they probably would have followed temperatures measured at a 25 cm depth more closely. In 1985, this depth was not monitored. Inshore surface water temperatures were measured at various times during each sampling date and were therefore subject to the high diurnal variation previously described.

WATER TRANSPARENCY

Water transparency measurements were similar in both years at offshore stations. The amount of suspended particulate matter absorbing light in Dauphin Lake is dominated by the silty-clay and clayey-silt sediments of the basin. Suspended solids in the water column were measured in 1982 with a maximum of 363·mg L^{-1} and normal values ranging between 40-60·mg L^{-1} (J. Babaluk and M. Friesen, personal communication).The orientation, length and mean depth of the lake, combined with the surrounding flat topography and dominant west and north-west winds (Canada Department of the Environment 1985, 1986) result in almost continuous surface wave action. Maximum wave heights estimated at 1.25 m occur periodically, often initiated by strong winds associated with storms. The unsettled weather conditions of spring and fall are characteristically windy and result in low transparency measurements. These measurements are a function of a combination of factors which include the maximum wind speed, wind direction and duration and several others. For this reason each wind event is unique, affecting the water body and transparency differently. Daily variation in water transparency supports this fact. This variability may be explained by the area sampled (eg. north vs south basin), location sampled (eg. offshore vs inshore), time of day and daily weather conditions.

Suspended particulates of the water column are responsible for absorbing and scattering light penetrating a lake (Wetzel 1983). The high turbidity of Dauphin Lake produces large changes in light intensity over small variations in depth. Figure 7 illustrates changes in light transmission in Dauphin Lake at three different turbidities. Under certain conditions, light intensity decreases by over four orders of magnitude in the top 1 m of water. Turbidity therefore, by restricting the penetration of light, affects light characteristics and ultimately fish vision and subsequent behavioral responses.

IMPLICATIONS OF WATER TEMPERATURE AND TRANSPARENCY TO FISH

Water temperature

Water temperature may affect many aspects of fisheries ecology. Some of these include growth (Brett 1979), survival (Fry 1971), timing of gonadal maturation (Stacey 1984) and spawning (Bye 1984), migration (Harden-Jones 1968), activity (Fry 1947) and ultimately distribution and abundance. Although no data is presented here, some implications are addressed.

In Dauphin Lake, the warmer water temperatures of 1984 provided better growth conditions for fish than in 1985. Extreme temperatures of over 30°C at inshore stations did not seriously affect fish survival in 1984 since they occurred for only a short period of time and offshore water temperatures remained more moderate. Diurnal temperature fluctuation in the shallow margins of the lake was sometimes severe (Maximum = 14.5°C) and would be expected to influence fish movements on and offshore. Summerkills of inshore fish is a common occurrence in Dauphin Lake (W. Howard, Manitoba Department of Natural Resources, Brandon, MB, personal communication). However, major die-offs have been associated with intense algae "blooms" rather than with temperature alone. The relationship between oxygen saturation and water temperature (Wetzel 1983) indicates that temperature plays an important role in determining oxygen concentrations available to fish inhabiting inshore areas during "bloom" conditions, most importantly at night.

Water transparency

Though factors regulating water transparency do not appear to directly affect fish physiology, behavioral modifications do occur. The ability of an individual to detect prey, predators or conspecifics is biologically critical. Vision by fish is important for locating and capturing food (Blaxter 1970), detecting and finding refuge from predators (Brock and Riffenburgh 1960) and receiving visual cues for mating or schooling (Shaw 1978).

Many species exhibit feeding periodicities based on light intensity (time of day). In clear water, dusk and dawn are periods of increased feeding activity for many piscivorous fish (eg. Ryder 1977). In turbid waters walleyes have been found to feed throughout the day (Mathias and Li 1982; Ryder 1977). Increased feeding opportunity may also occur in the Dauphin Lake walleye population due to the characteristically high turbidity of the lake.

Schooling species may be affected by turbidity as well. The attraction and maintenance of a school is almost wholly based on vision (Breder 1954; Keenleyside 1955) and is therefore dependent on light intensity and water transparency. For this reason schooling fish tend to disperse at night and in turbid waters (Cushing and Harden-Jones 1968). Schooling fishes are characteristically prey species occupying open water which provides few areas of shelter or refuge (Brock and Riffenburgh 1960). As schooling is a defence mechanism which decreases the likelihood of detection by a predator (Shaw 1978), the breakdown of a school may render the prey more vulnerable to predation. In Dauphin Lake, high turbidity may cause the breakdown of fish schools due to the loss of visual contact

between individuals. Species schooling near the lake bottom, where light levels are at a minimum, would be particularly sensitive.

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Table 1. Collection dates, location, depth and equipment used for water temperature monitoring, Dauphin Lake, 1984 and 1985.

Year	Date		Location	Depth (cm)	Equipment
	Start	Finish			
1984	June 5	Sept 4	East Shore	25	Recording Thermometer
	June 5	Sept 16	East Shore	50	Recording Thermometer
	July 4	Sept 19	East Shore	100	Recording Thermometer
	May 30	Aug 12	Offshore	Surface	Hand-held Thermometer
1985	May 29	Aug 28	East Shore	50	Recording Thermometer
	May 22	Oct 13	East Shore	100	Recording Thermometer
	May 16	Sept 28	Offshore	Surface	Hand-held Thermometer
	May 27	Sept 29	Inshore	Surface	Hand-held Thermometer

Table 2. Mean offshore surface water temperatures, mean air temperatures and mean secchi depths measured on trawling dates at Dauphin Lake, 1984 and 1985.

	1984			1985		
Date	Mean Surface Temp. (° C)	Mean Air Temp. (° C)	Mean Secchi (cm)	Mean Surface Temp. (° C)	Mean Air Temp. (° C)	Mean Secchi (cm)
May 30	18.2	23.1	25			
June 11	17.6	18.8	24	15.7	13.8	24
June 21	19.6	19.0	17			
June 25				14.4	13.6	21
July 10	21.9	22.5	m	21.8	19.3	23
July 24				19.7	19.6	30
July 27	22.2	21.6	43			
Aug 8				19.7	21.8	23
Aug 10	20.8	27.2	27			
Aug 22				16.3	18.0	26
Sept 28				5.2	5.3	10

m=Missing data

Table 3. · Monthly air temperature summaries for the Dauphin Lake region, 1984 and 1985 (Data from Canada Department of the Environment *).

Month		1984 Mean Temp. (°C)	1984 Degrees (°C) from Normal	1985 Mean Temp. (°C)	1985 Degrees (°C) from Normal
May	Max.	15.4	-1.9	19.3	+2.0
	Min.	2.3	-0.9	4.0	+0.8
	Mean	8.9	-1.4	11.7	+1.4
June	Max.	23.2	+0.8	18.5	-3.9
	Min.	9.9	+0.9	7.3	-1.7
	Mean	16.6	+0.8	12.9	-2.9
July	Max.	25.9	+0.8	24.8	-0.3
	Min.	11.6	-0.3	10.3	-1.6
	Mean	18.8	+0.3	17.6	-0.9
Aug	Max.	27.7	+3.9	20.7	-3.1
	Min.	11.8	+1.4	8.4	-2.0
	Mean	19.8	+2.7	14.6	-2.5
Sept	Max.	14.8	-2.6	14.3	-3.1
	Min.	3.6	-1.5	3.5	-1.6
	Mean	9.2	-2.1	8.9	-2.4

*All measurements recorded at Department of the Environment Dauphin Airport Meteorological Site (51° 06'N, 100° 03'W, Altitude=304m)

Table 4. Monthly sunshine and calculated degree-day (>10 °C) summaries for the Dauphin Lake region, 1984 and 1985 (Data from Canada Deptartment of the Environment *).

Month		1984 Total	1984 % of Normal	1985 Total	1985 % of Normal
May	Sun-Hours	236.5	89	276.0	104
	Degree-Days	66.2		78.0	
June	Sun-Hours	267.1	98	m	m
	Degree-Days	196.9		101.3	
July	Sun-Hours	341.2	106	346.2	107
	Degree-Days	272.6		226.3	
August	Sun-Hours	304.3	111	211.4	77
	Degree-Days	304.0		142.8	
September	Sun-Hours	148.6	83	143.3	80
	Degree-Days	43.4		47.2	

m=missing data
*All measurements recorded at Department of the Environment Dauphin Airport Meteorological Site (51° 06'N, 100° 03'W, Altitude=304m)

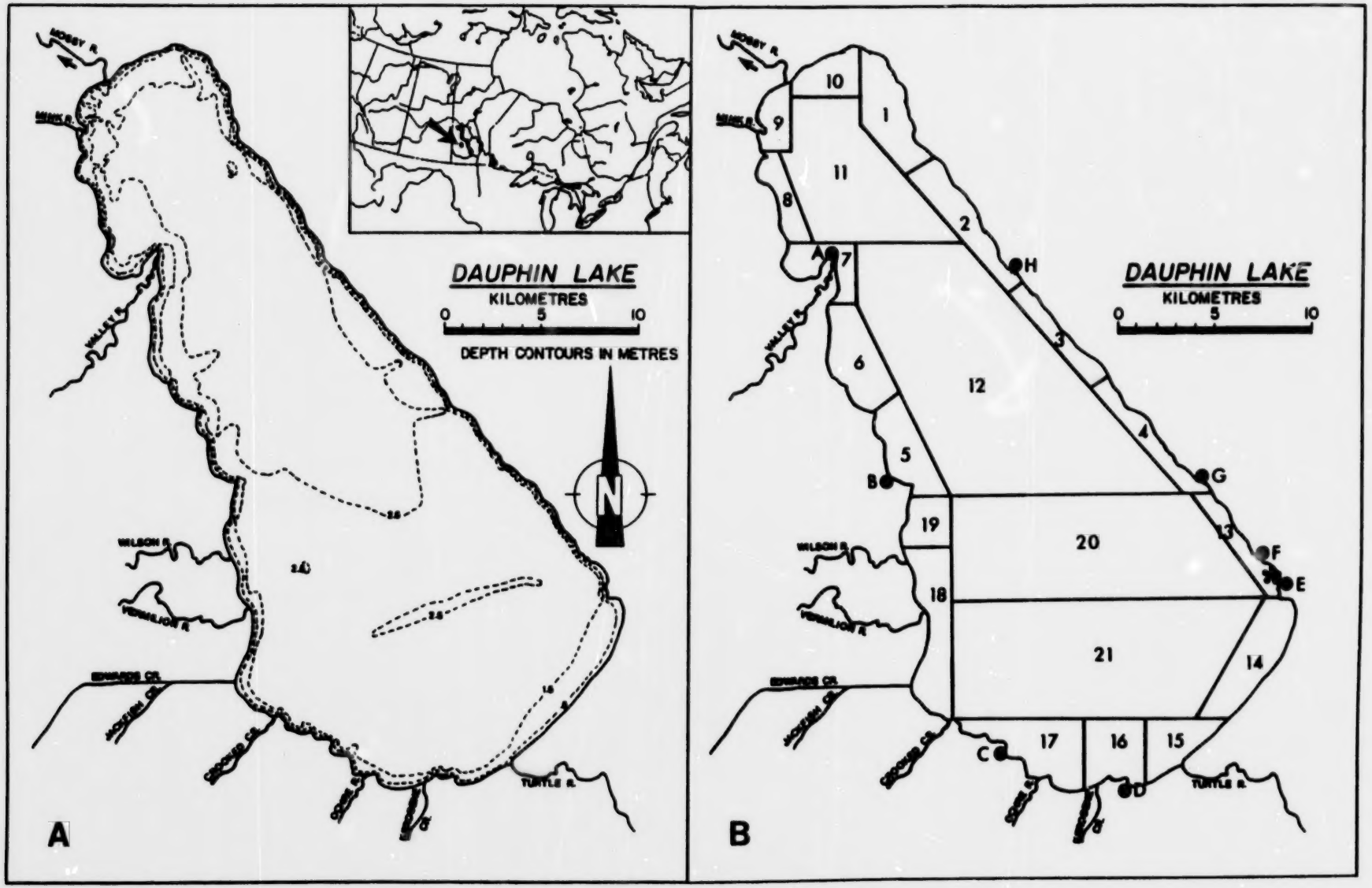

Fig. 1. Map of Dauphin Lake showing: A. location and lake bathymetry and B. continuous-recording temperature station (*), inshore surface temperature (●) and offshore surface temperature and transparency (i.e. **5**) monitoring locations.

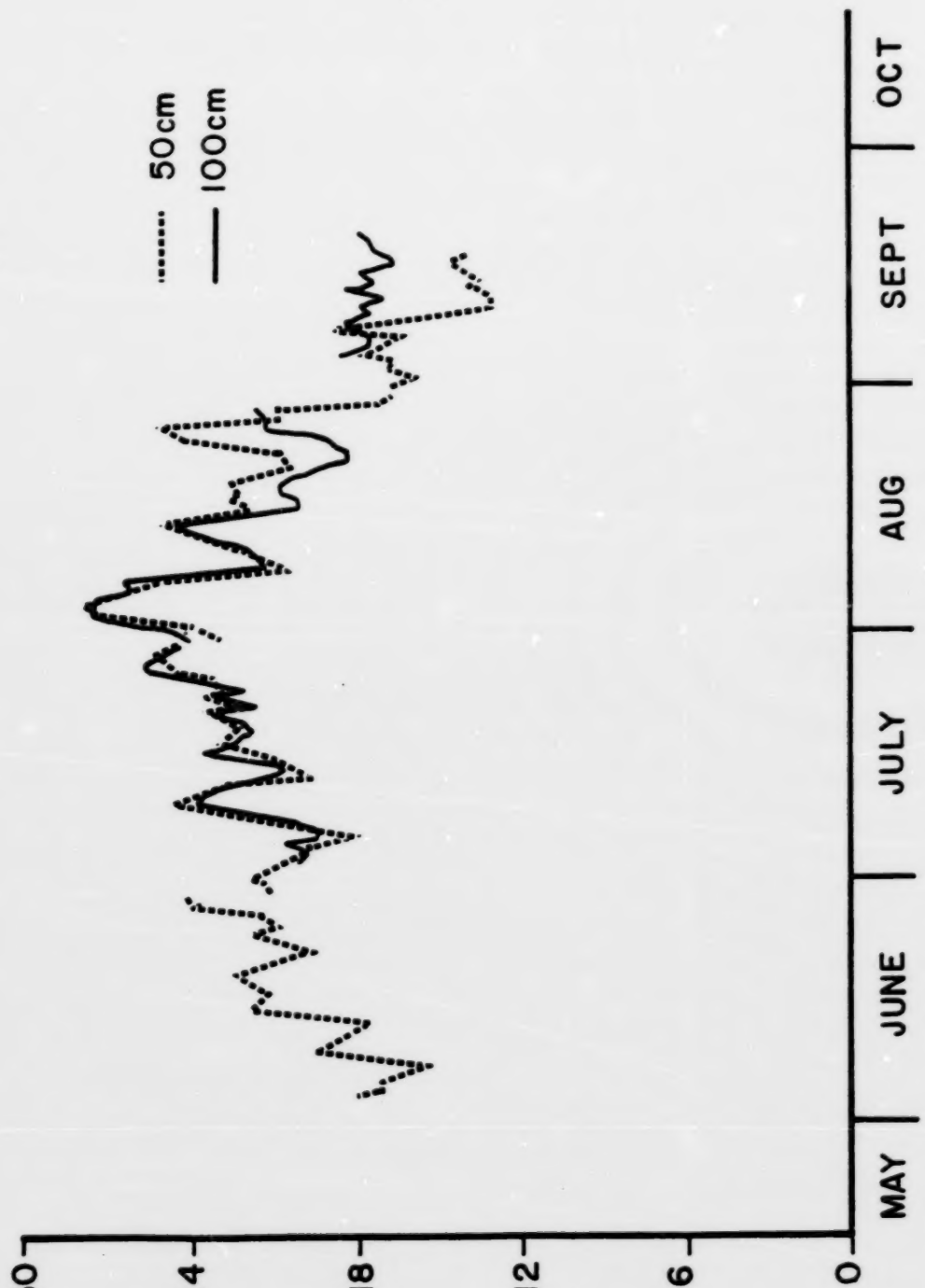

Fig. 2. Inshore mean daily water temperatures measured on the bottom at 50 and 100 cm depths, Dauphin Lake, 1984.

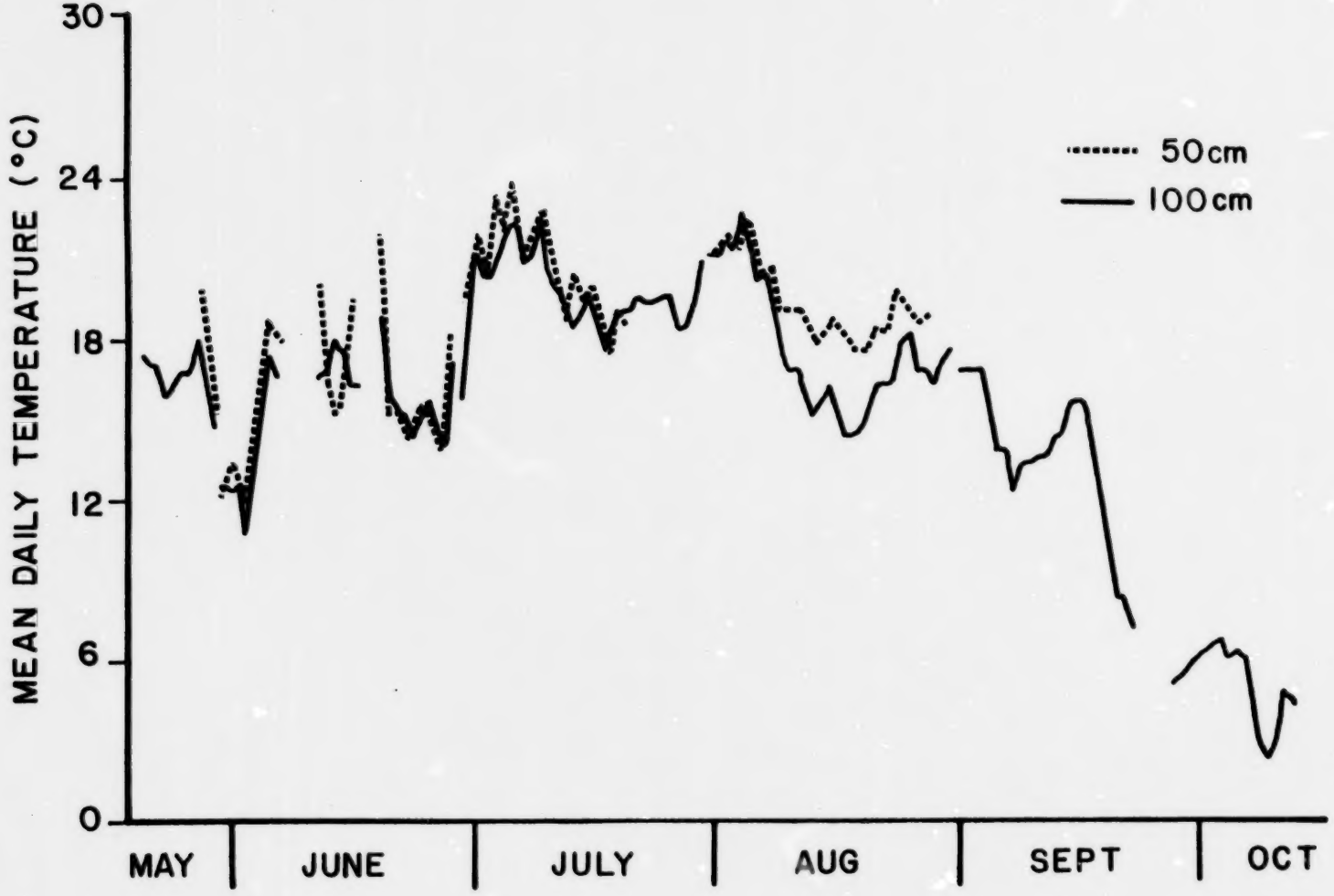

Fig. 3. Inshore mean daily water temperatures measured on the bottom at 50 and 100 cm depths, Dauphin Lake, 1985.

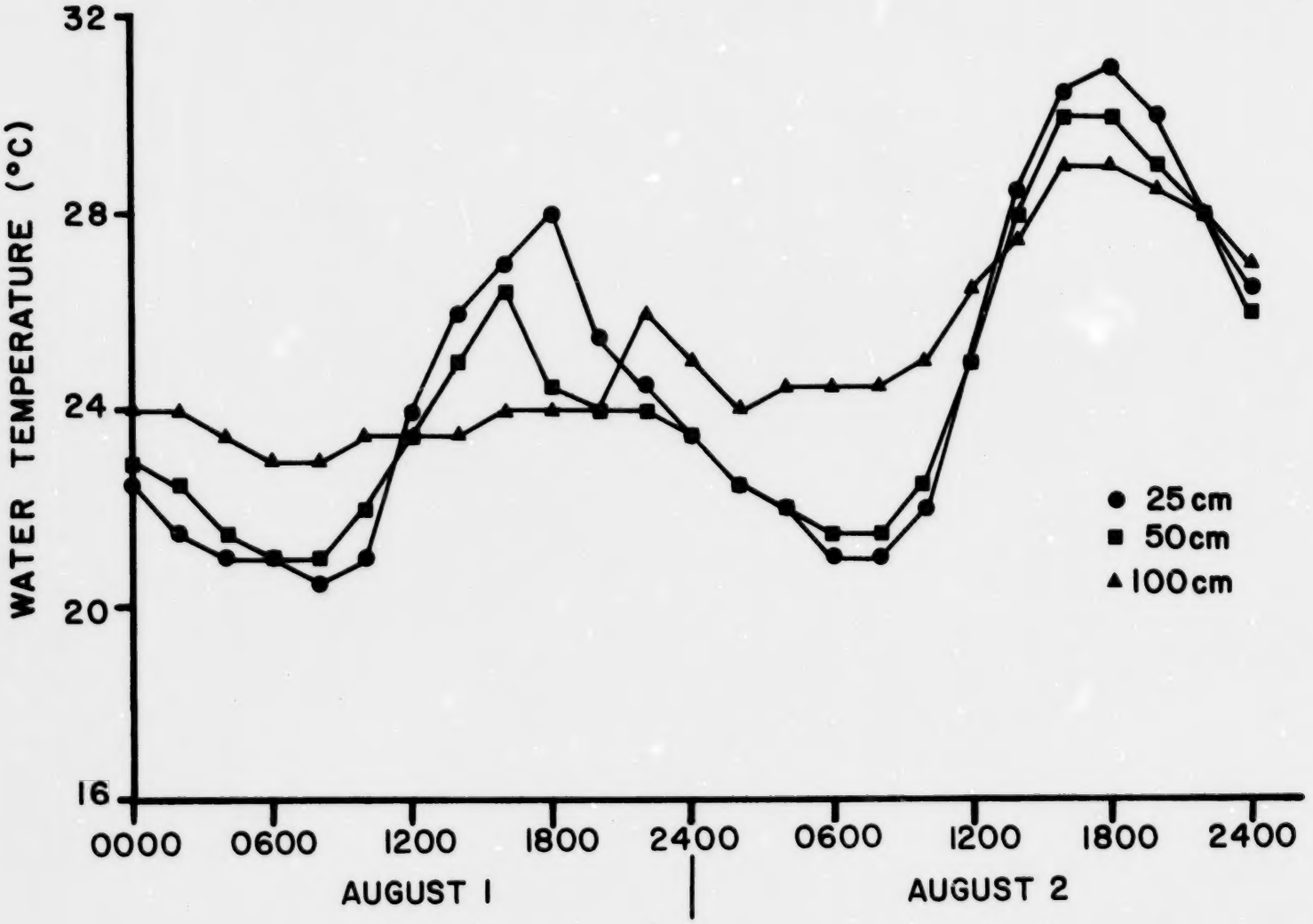

Fig. 4. Diurnal water temperature variation at three depths in Dauphin Lake, 1984.

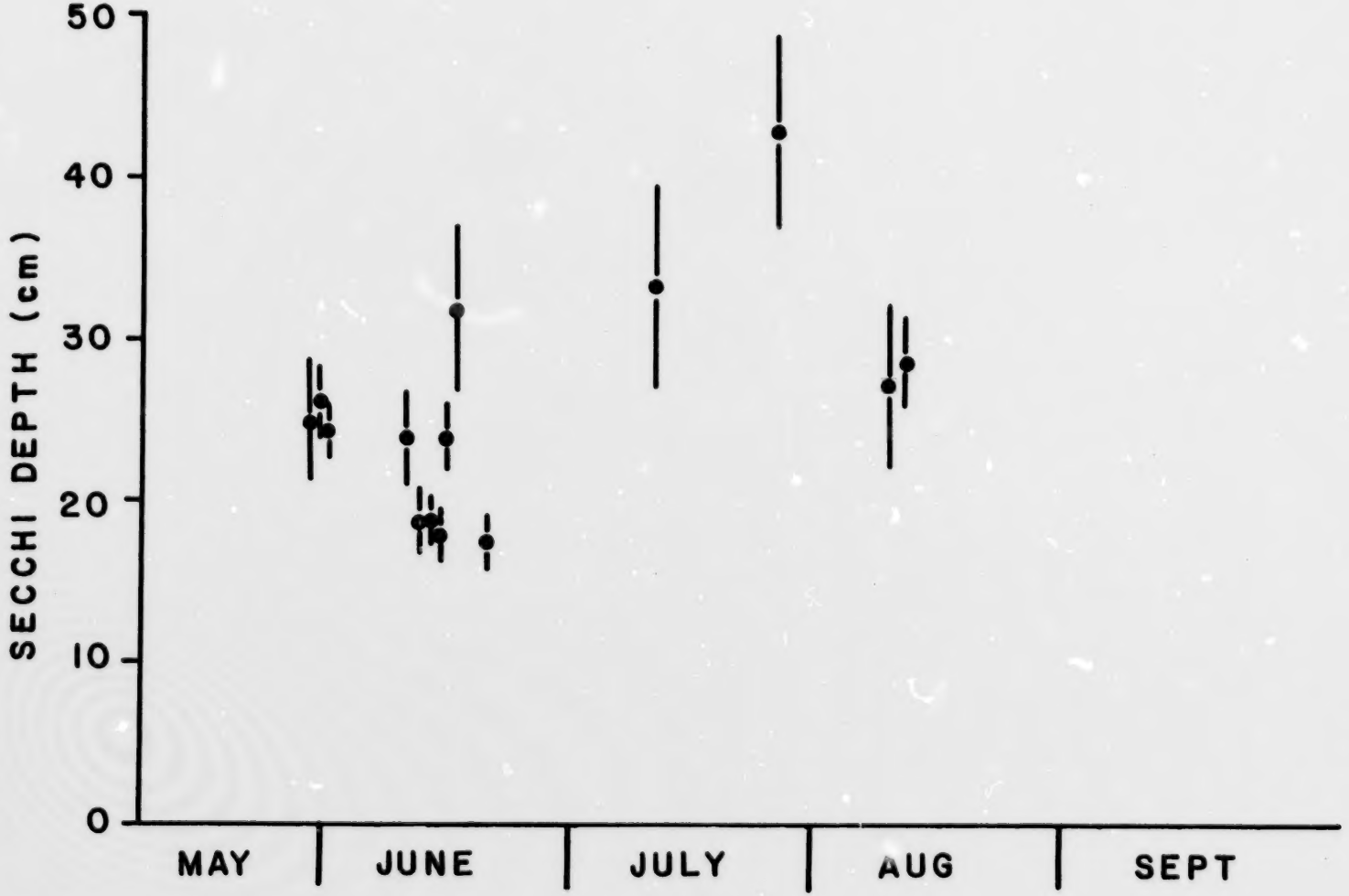

Fig. 5. Mean secchi disc measurements at various locations in Dauphin Lake, 1984.

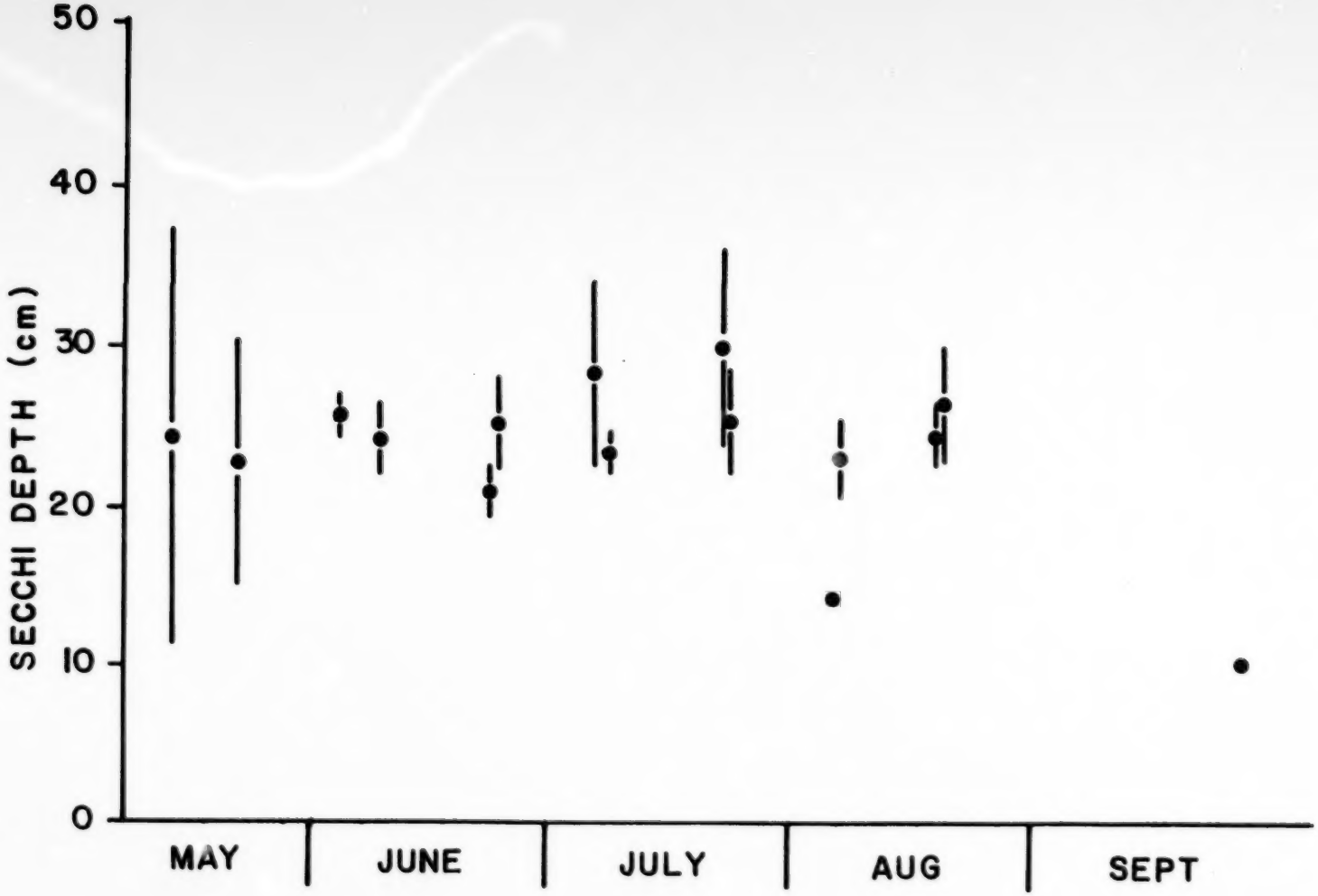

Fig. 6. Mean secchi disc measurements at various locations in Dauphin Lake, 1985.

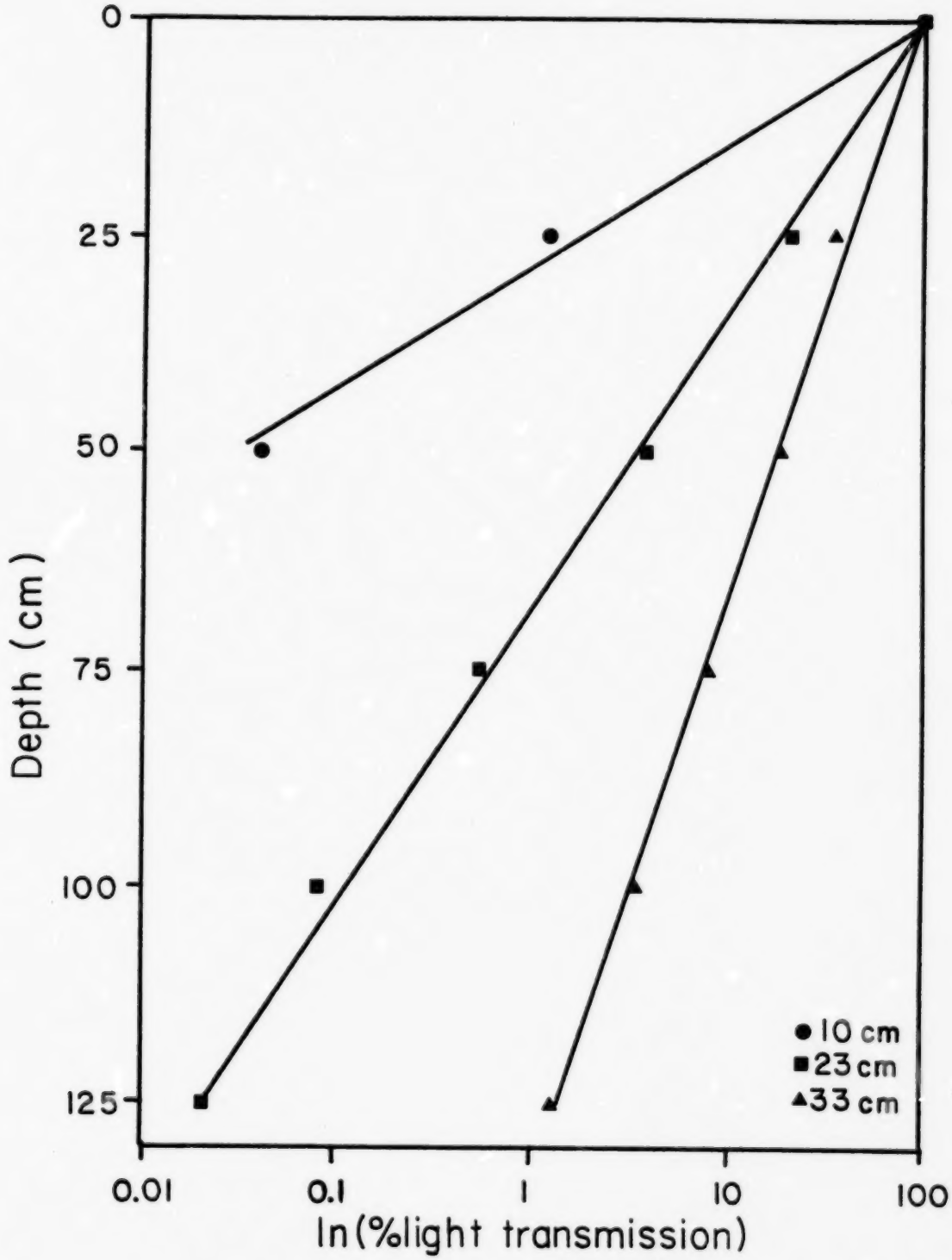

Fig. 7. Light transmission at three different secchi depths in Dauphin Lake, 1985.

Appendix 1. Inshore water temperatures measured by continuous-recording thermometer, Dauphin Lake, 1984.

Depth	Date	Temperatures (°C) 0600 (h)	1200 (h)	1800 (h)	2400 (h)	Max.	Min.	Mean
25cm	Jun 5	M	M	M	17.5	18.0	17.5	17.8
	6	16.0	16.0	16.0	15.5	17.5	15.5	16.5
	7	15.0	16.0	18.5	17.0	18.5	15.0	16.8
	8	16.0	17.0	17.0	15.0	17.5	15.0	16.3
	9	13.5	14.5	17.5	14.5	17.5	13.0	15.3
	10	11.5	17.0	22.5	18.5	22.5	11.5	17.0
	11	15.0	21.5	26.0	20.0	26.5	15.0	20.8
	12	16.5	19.5	20.0	17.5	20.5	16.5	18.5
	13	19.5	18.0	21.5	19.0	23.0	13.5	18.3
	14	15.0	19.5	21.5	19.0	21.5	15.0	18.3
	15	17.0	21.0	22.5	20.0	24.0	17.0	20.5
	16	18.0	24.0	23.0	19.5	25.5	17.5	21.5
	17	18.0	21.0	23.0	19.5	23.5	17.5	20.5
	18	16.5	19.5	24.5	21.5	25.0	15.5	20.3
	19	14.0	21.5	24.0	21.0	24.5	18.5	21.5
	20	18.5	21.5	26.0	22.5	26.0	18.5	22.3
	21	20.0	20.5	22.0	21.0	22.5	20.0	21.3
	22	20.0	20.5	21.5	19.0	21.5	19.0	20.3
	23	17.0	17.5	21.5	18.5	21.5	16.5	19.0
	24	16.5	20.0	27.0	23.5	27.0	15.5	21.3
	25	19.5	20.0	25.0	21.5	25.0	18.5	21.8
	26	19.5	19.0	23.0	21.0	23.0	18.5	20.8
	27	19.0	21.0	24.5	23.0	26.0	18.5	22.3
	28	21.0	22.0	27.0	24.0	27.0	20.0	23.5
	29	21.0	23.0	27.5	23.5	28.0	20.0	24.0
	30	20.0	21.5	19.5	18.0	23.5	18.0	20.8
25cm	Jul 1	17.0	20.0	24.5	21.0	25.0	16.5	20.8
	2	19.0	21.5	23.5	21.0	24.0	18.5	21.3
	3	19.0	19.5	22.0	20.0	22.5	18.0	20.3
	4	18.0	18.0	23.0	21.0	23.0	16.5	19.8
	5	18.0	18.0	20.5	18.5	21.0	17.5	19.3
	6	16.0	17.5	25.0	21.0	25.0	15.5	20.3
	7	16.0	16.5	18.0	18.0	20.5	15.0	17.8
	8	17.0	17.5	24.0	23.0	25.0	16.0	20.5
	9	19.0	18.5	23.0	22.0	23.0	17.5	20.3
	10	20.0	20.0	26.5	23.5	27.0	19.0	23.0
	11	21.0	22.5	27.5	24.5	27.5	20.0	23.8
	12	22.0	23.0	24.5	23.0	24.5	21.0	22.8
	13	20.5	22.0	26.5	23.0	27.0	20.0	23.5
	14	19.5	19.0	19.5	18.0	23.0	18.0	20.5
	15	16.0	19.0	26.5	23.0	27.0	16.0	21.5
	16	19.0	19.0	22.0	19.0	23.0	18.5	20.8
	17	17.5	20.0	29.0	24.0	29.0	17.0	23.0
	18	20.5	21.0	25.5	22.0	25.5	20.0	22.8
	19	19.5	22.5	25.5	22.5	26.5	19.0	22.8

Appendix 1. Inshore water temperatures measured by continuous-recording thermometer, Dauphin Lake, 1984.

Depth	Date	Temperatures (°C) 0600 (h)	1200 (h)	1800 (h)	2400 (h)	Max.	Min.	Mean
	20	19.5	21.5	27.0	21.5	27.5	19.0	23.3
	21	20.0	21.5	26.0	23.5	27.0	20.0	23.5
	22	21.5	21.5	24.5	20.5	24.5	20.5	22.3
	23	18.0	21.0	25.0	22.0	25.0	17.5	21.3
	24	19.0	23.5	30.0	24.0	30.5	18.5	24.5
	25	20.0	22.0	26.0	23.0	26.0	20.0	23.0
	26	19.5	23.0	28.5	19.0	28.5	19.5	24.0
	27	20.5	25.0	30.5	24.0	30.5	20.0	25.3
	28	20.5	24.5	29.5	25.5	30.0	20.0	25.0
	29	23.0	24.5	29.0	25.0	29.5	22.0	25.8
	30	23.5	24.0	26.5	24.0	26.5	23.0	24.8
	31	22.0	22.5	24.5	22.5	24.5	21.5	23.0
25cm	Aug 1	21.0	24.0	28.0	23.5	28.0	20.0	24.0
	2	21.0	25.0	31.0	26.5	31.0	20.5	25.8
	3	22.5	27.0	31.5	27.0	31.5	22.5	27.0
	4	23.5	27.5	32.0	27.0	32.5	23.0	27.8
	5	23.5	28.0	26.5	24.0	29.5	23.5	26.5
	6	23.0	25.0	29.0	25.5	29.5	22.5	26.0
	7	22.5	23.0	27.0	23.5	27.0	22.5	24.8
	8	19.5	20.5	21.0	19.5	21.5	19.0	20.3
	9	18.5	19.5	23.0	20.0	23.0	18.0	20.5
	10	17.0	21.0	22.5	18.0	28.0	16.5	22.3
	11	17.0	22.0	27.0	22.0	27.0	16.0	21.5
	12	20.5	23.0	26.0	23.5	26.0	20.0	23.0
	13	21.0	23.5	28.5	25.0	28.5	20.5	24.5
	14	23.0	23.0	26.0	20.5	26.5	22.0	24.3
	15	18.0	21.0	25.0	19.5	25.5	17.0	21.3
	16	16.5	21.0	26.5	21.0	26.5	15.5	21.0
	17	19.5	22.5	25.5	21.5	26.0	19.0	22.5
	18	18.5	21.0	26.5	21.0	26.5	18.0	22.3
	19	19.0	24.5	26.5	21.0	27.0	18.5	22.8
	20	20.0	20.5	23.0	19.0	23.5	18.5	21.0
	21	16.5	18.5	18.5	16.0	19.0	16.0	17.5
	22	14.0	18.0	25.0	13.0	25.5	13.5	19.5
	23	12.5	20.0	24.5	17.0	26.5	12.0	19.3
	24	15.0	20.0	26.0	19.5	26.5	15.0	20.8
	25	18.0	22.5	28.0	22.0	29.5	18.0	23.8
	26	18.5	23.5	29.5	23.5	30.5	18.5	24.5
	27	19.5	24.0	28.5	23.0	30.0	19.0	24.5
	28	19.0	20.5	21.0	17.0	21.5	18.5	20.0
	29	13.0	16.0	16.5	14.5	17.5	12.0	19.8
	30	13.0	14.0	16.5	13.0	17.0	13.0	15.0
	31	11.0	14.5	18.5	10.5	19.5	10.5	15.0
25cm	Sep 1	9.5	14.0	19.5	14.0	19.5	9.0	14.3

Appendix 1. Inshore water temperatures measured by continuous-recording thermometer, Dauphin Lake, 1984.

Depth	Date	Temperatures (°C) 0600 (h)	1200 (h)	1800 (h)	2400 (h)	Max.	Min.	Mean
	2	12.5	13.5	19.5	13.0	20.5	11.5	16.0
	3	12.0	12.0	18.0	14.0	19.0	12.0	15.5
	4	12.0	13.0	21.0	M	21.0	11.5	16.3
50cm	Jun 5	M	M	M	17.5	18.5	17.5	18.0
	6	16.5	16.5	16.5	16.0	18.0	16.0	17.0
	7	15.0	16.5	19.0	17.5	19.0	15.0	17.0
	8	16.0	17.0	17.0	15.0	17.5	15.0	16.3
	9	14.0	14.5	17.0	15.0	17.0	13.5	15.3
	10	13.0	16.5	19.0	18.5	22.0	13.0	17.5
	11	16.0	18.5	20.0	19.0	22.5	16.0	19.3
	12	17.0	20.0	20.0	18.0	20.0	17.0	18.5
	13	15.5	17.5	21.0	18.0	21.0	15.0	18.0
	14	15.5	18.0	20.5	18.5	20.5	15.0	17.8
	15	12.0	18.5	21.5	20.5	22.5	16.5	19.5
	16	19.0	21.5	23.0	20.5	25.0	18.5	21.8
	17	19.0	21.0	22.5	21.0	23.5	19.0	21.3
	18	18.5	19.5	23.5	23.0	24.0	18.0	21.0
	19	20.0	21.5	24.5	21.5	24.5	19.5	22.0
	20	19.5	22.0	25.5	22.0	25.5	19.0	22.3
	21	20.5	21.0	22.0	21.5	22.5	20.5	21.5
	22	20.0	20.5	21.0	19.5	21.0	19.5	20.3
	23	18.0	19.0	20.5	19.0	21.0	17.5	19.3
	24	17.5	20.0	24.0	22.5	24.0	17.0	20.5
	25	19.5	22.0	24.5	21.5	24.5	19.0	21.8
	26	19.5	20.0	23.0	21.0	23.0	18.5	20.8
	27	19.5	20.0	23.0	23.0	23.5	19.0	21.3
	28	21.5	23.0	26.5	23.5	26.5	21.0	23.8
	29	21.5	23.5	27.0	23.5	27.0	21.0	24.0
	30	20.5	22.0	20.0	18.5	23.5	18.5	21.0
50cm	Jul 1	17.5	19.5	25.0	22.0	25.5	17.0	21.3
	2	20.0	22.0	24.0	22.0	24.0	19.5	21.8
	3	19.5	20.5	22.5	21.0	23.0	19.0	21.0
	4	19.0	20.0	23.0	20.5	23.0	18.5	20.8
	5	18.5	19.0	21.0	19.0	21.0	18.5	19.8
	6	16.5	18.0	22.5	20.0	23.0	16.5	19.8
	7	16.5	17.5	18.5	18.0	18.5	16.0	17.3
	8	17.0	18.5	23.0	22.5	23.5	16.5	20.0
	9	19.0	20.5	24.0	22.5	24.0	19.0	21.5
	10	20.5	22.0	27.0	24.5	27.0	20.0	23.5
	11	22.0	23.5	28.0	24.5	27.5	21.5	24.5
	12	23.0	23.5	24.5	23.0	24.5	22.5	23.5
	13	21.0	22.0	25.5	23.0	25.5	20.0	22.8
	14	19.5	19.0	20.0	18.5	20.0	18.5	19.3
	15	17.0	19.0	22.5	22.0	23.0	17.0	20.0
	16	19.5	20.0	22.0	20.0	22.0	19.5	20.8

Appendix 1. Inshore water temperatures measured by continuous-recording thermometer, Dauphin Lake, 1984.

Depth	Date	Temperatures (°C) 0600 (h)	1200 (h)	1800 (h)	2400 (h)	Max.	Min.	Mean
	17	18.5	20.0	23.5	24.5	25.5	18.0	21.8
	18	21.5	22.0	24.5	23.0	25.0	21.0	23.0
	19	20.5	22.0	24.5	22.0	25.0	20.0	22.5
	20	19.5	20.5	20.0	22.5	25.5	19.0	22.3
	21	20.0	20.5	24.5	24.0	24.5	20.0	22.3
	22	23.0	22.0	24.5	22.5	24.5	22.0	23.3
	23	20.0	20.5	24.0	23.0	24.0	20.0	22.0
	24	20.5	22.0	26.0	23.0	26.5	20.0	23.3
	25	20.5	22.0	25.0	22.5	25.0	20.5	22.8
	26	20.0	22.0	26.0	24.0	26.0	20.0	23.0
	27	21.0	23.5	28.0	23.5	28.0	21.0	24.5
	28	21.0	23.5	29.0	26.0	29.0	20.5	24.8
	29	23.5	24.0	28.0	25.0	28.0	22.5	25.3
	30	24.0	24.0	26.0	24.5	26.0	23.0	24.5
	31	22.5	23.0	24.5	23.0	24.0	22.0	23.0
50cm	Aug 1	21.0	23.5	24.5	23.5	26.5	20.5	23.5
	2	21.5	25.0	30.0	27.0	30.0	21.0	25.5
	3	24.0	27.5	30.5	27.0	30.5	23.5	27.0
	4	24.0	27.5	31.5	27.5	31.5	24.0	27.8
	5	24.5	27.5	26.5	24.5	29.5	24.0	26.8
	6	23.0	25.0	28.5	26.0	28.5	23.0	25.8
	7	23.5	23.5	27.5	24.0	27.5	23.0	25.3
	8	20.5	21.0	21.5	20.0	21.5	20.0	20.8
	9	19.0	19.5	22.5	20.5	22.5	18.5	20.5
	10	18.0	21.0	26.0	21.0	26.0	17.5	21.8
	11	18.0	22.5	26.0	22.0	26.0	18.0	22.0
	12	20.5	23.5	25.0	23.0	25.0	20.5	22.8
	13	21.5	24.5	27.0	24.5	27.0	21.5	24.3
	14	23.0	23.5	25.5	21.5	26.0	23.0	24.5
	15	19.0	21.0	25.0	22.0	25.0	18.0	21.5
	16	19.0	20.5	25.0	22.0	25.0	18.5	21.8
	17	20.0	22.5	25.0	22.0	25.0	20.0	22.5
	18	19.5	20.5	25.5	22.0	25.5	19.0	22.3
	19	19.0	23.5	26.0	22.0	26.0	19.0	22.5
	20	20.5	21.0	22.5	19.0	23.0	19.5	21.3
	21	M	17.0	24.0	21.0	24.0	16.5	20.3
	22	M	M	24.5	20.5	24.5	16.5	20.5
	23	17.5	19.5	24.0	20.5	24.5	17.0	20.8
	24	19.5	22.0	27.0	23.0	27.0	19.5	23.3
	25	21.0	23.5	28.5	23.0	29.0	20.5	24.8
	26	21.0	23.5	29.0	24.5	29.0	21.0	25.0
	27	21.5	21.5	23.0	M	23.0	18.5	20.8
	28	M	M	23.0	19.0	23.0	18.5	20.8
	29	16.0	18.5	18.5	16.5	19.0	15.5	17.3
	30	15.0	15.5	17.5	15.5	18.0	15.0	16.5
	31	13.5	16.5	19.5	16.0	19.5	13.5	16.5

Appendix 1. Inshore water temperatures measured by continuous-recording thermometer, Dauphin Lake, 1984.

Depth	Date	Temperatures (°C) 0600 (h)	1200 (h)	1800 (h)	2400 (h)	Max.	Min.	Mean
50cm	Sep 1	13.5	16.5	18.0	15.5	18.0	13.5	15.8
	2	15.0	16.0	19.0	15.5	19.0	14.5	16.8
	3	14.5	15.5	18.0	15.0	19.0	14.0	16.5
	4	14.0	18.5	20.5	18.0	21.5	14.0	17.8
	5	14.5	16.0	20.0	16.0	20.0	14.0	17.0
	6	13.0	16.5	20.5	17.5	20.5	12.0	16.3
	7	16.0	17.5	21.0	18.5	22.0	15.5	18.8
	8	17.0	15.5	15.0	14.0	18.5	14.0	16.3
	9	12.5	14.0	16.0	14.0	16.0	12.0	14.0
	10	12.5	12.5	14.0	12.0	14.0	12.0	13.0
	11	11.0	12.0	16.0	14.0	16.0	10.0	13.0
	12	13.5	13.5	15.0	13.5	15.0	12.5	13.8
	13	12.0	13.0	15.0	13.0	15.0	12.0	13.5
	14	12.0	13.0	16.0	13.0	16.5	11.5	14.0
	15	11.5	13.0	18.0	14.0	18.0	11.0	14.5
	16	11.0	14.0	17.5	15.0	17.5	10.5	14.0
100cm	Jul 4	M	M	20.5	19.5	20.5	19.5	20.0
	5	19.0	19.5	20.5	19.5	20.5	19.0	19.8
	6	19.0	22.5	21.5	20.5	22.5	18.5	20.5
	7	19.5	19.0	19.0	18.0	20.5	18.0	19.3
	8	17.5	20.5	21.0	19.5	21.5	17.5	19.5
	9	M	20.5	22.0	20.5	22.5	18.5	20.5
	10	19.0	22.5	25.0	24.0	25.0	19.0	22.0
	11	21.5	22.0	25.5	24.0	26.0	21.5	23.8
	12	23.0	23.0	24.0	23.0	24.0	22.5	23.3
	13	22.0	22.0	23.5	23.0	23.5	22.0	22.8
	14	20.5	21.0	21.0	20.0	23.0	20.0	21.5
	15	18.5	20.0	22.0	21.5	22.5	18.5	20.5
	16	20.0	21.0	21.5	20.5	22.0	20.0	21.0
	17	19.5	22.5	21.0	23.5	27.5	19.5	23.5
	18	21.5	22.0	23.5	22.0	23.5	21.5	22.5
	19	21.0	22.0	23.5	21.0	23.5	21.0	22.3
	20	20.5	21.5	23.0	22.0	23.0	20.5	21.8
	21	21.0	21.5	23.5	23.0	23.5	20.5	22.0
	22	22.5	23.0	23.5	22.0	24.0	22.0	23.0
	23	20.0	21.5	23.0	22.0	23.0	20.0	21.5
	24	21.5	24.5	22.0	22.0	25.0	21.0	23.0
	25	21.0	22.5	23.0	22.0	23.0	21.0	22.0
	26	21.5	23.5	26.0	24.0	26.0	21.5	23.8
	27	22.5	26.0	23.5	23.5	28.5	22.5	25.5
	28	23.0	25.0	27.0	25.5	28.0	23.0	25.5
	29	24.5	25.0	25.5	24.5	26.0	24.0	25.0
	30	24.0	24.0	25.0	24.5	25.0	23.5	24.3
	31	23.5	24.0	24.5	24.0	24.5	23.5	24.0

Appendix 1. Inshore water temperatures measured by continuous-recording thermometer, Dauphin Lake, 1984.

Depth	Date	Temperatures (°C) 0600 (h)	1200 (h)	1800 (h)	2400 (h)	Max.	Min.	Mean
100cm	Aug 1	23.0	23.5	24.0	25.0	26.0	23.0	24.5
	2	24.5	26.5	29.0	27.5	29.0	24.0	26.5
	3	26.0	28.0	28.5	26.5	29.0	26.0	27.5
	4	25.5	28.0	27.5	27.0	29.5	25.5	27.5
	5	26.0	27.5	27.0	26.0	28.5	26.0	27.3
	6	25.0	26.0	27.0	26.5	27.0	25.0	26.0
	7	25.5	25.5	28.0	25.5	27.5	25.0	26.3
	8	23.0	23.0	23.0	21.5	25.5	21.5	23.5
	9	21.0	21.0	22.0	21.0	22.0	20.5	21.3
	10	20.0	21.5	23.0	21.0	23.0	20.0	21.5
	11	20.0	22.0	23.5	22.0	23.5	20.0	21.8
	12	21.5	23.0	23.0	22.0	23.5	22.0	22.8
	13	22.0	24.0	24.5	24.5	25.5	22.0	23.8
	14	24.0	24.5	25.0	23.0	26.0	23.0	24.5
	15	21.0	20.0	21.5	21.0	25.0	20.0	22.5
	16	20.5	19.5	21.0	21.0	21.0	19.0	20.0
	17	20.5	19.0	21.0	21.5	21.5	18.5	20.0
	18	21.0	19.5	22.0	21.5	22.0	19.5	20.8
	19	21.0	20.0	22.0	21.5	22.0	19.5	20.8
	20	20.5	19.0	21.0	20.5	21.5	19.0	20.3
	21	19.5	18.5	19.0	19.5	20.5	18.5	19.5
	22	19.0	16.5	20.0	19.5	20.0	16.5	18.3
	23	19.0	17.0	19.0	20.0	20.0	16.5	18.3
	24	19.0	18.0	19.0	19.5	19.5	18.0	18.8
	25	19.5	18.5	19.5	20.5	20.5	18.0	19.3
	26	20.0	19.0	23.0	20.5	23.5	19.0	21.3
	27	20.5	19.0	24.0	23.0	24.0	18.5	21.3
	28	22.0	21.0	21.0	20.0	23.0	20.0	21.5
100cm	Sep 4	M	M	M	18.5	18.5	18.5	18.5
	5	20.5	16.5	18.0	18.0	18.5	16.5	17.5
	6	18.0	17.5	17.5	18.0	18.0	17.0	17.5
	7	18.5	16.5	18.5	18.5	19.0	16.5	17.8
	8	19.0	18.0	18.0	18.0	18.5	18.0	18.3
	9	18.0	17.0	18.5	18.0	18.0	17.0	17.5
	10	18.0	18.0	17.5	18.0	18.0	17.5	17.8
	11	18.5	16.0	17.5	18.0	18.0	16.0	17.0
	12	20.0	18.0	18.0	18.5	18.5	18.0	18.3
	13	18.0	16.0	17.5	18.0	18.5	16.0	17.3
	14	18.0	17.0	17.0	18.0	18.5	17.0	17.8
	15	18.5	15.5	17.0	18.0	18.0	15.0	16.5
	16	18.0	15.5	18.0	18.0	18.0	15.5	16.8
	17	18.0	16.5	17.5	18.0	18.0	16.5	17.3
	18	18.5	16.0	18.5	19.0	19.0	16.0	17.5
	19	20.5	16.5	18.0	M	19.0	16.5	17.8

M = missing data

Appendix 2. Inshore water temperatures measured by continuous-recording thermometer, Dauphin Lake, 1985.

Depth	Date	Temperatures (°C) 0600 (h)	1200 (h)	1800 (h)	2400 (h)	Max.	Min.	Mean
50 cm	May 29	M	M	20.0	19.0	20.5	19.0	19.8
	30	18.0	18.0	17.5	16.5	19.0	16.5	17.8
	31	14.0	14.5	15.0	13.5	16.5	13.5	15.0
50 cm	Jun 1	11.0	11.5	11.5	11.0	13.5	10.5	12.0
	2	10.5	11.0	16.0	13.0	16.0	10.5	13.3
	3	12.0	12.5	12.5	12.0	13.0	12.0	12.5
	4	11.0	11.0	12.5	12.5	12.5	10.5	11.5
	5	11.5	13.0	18.5	17.0	18.5	11.0	14.8
	6	15.5	15.5	17.5	16.5	18.0	15.0	16.5
	7	15.0	15.5	21.5	19.0	22.5	14.5	18.5
	8	17.5	16.0	M	M	19.5	M	17.8
	13	M	20.5	23.0	17.0	23.0	17.0	20.0
	14	17.5	16.5	17.0	14.5	17.5	14.5	16.0
	15	14.5	16.0	16.0	14.0	16.0	14.0	15.0
	16	14.0	18.0	18.5	15.5	18.5	14.0	16.3
	17	15.5	23.0	22.0	18.5	23.0	15.5	19.3
	18	14.0	21.0	M	M	M	M	M
	20	M	M	22.5	21.0	22.5	21.0	21.8
	21	19.0	18.0	18.5	16.5	21.0	16.5	18.8
	22	14.0	14.0	14.0	13.5	16.5	13.5	15.0
	23	12.5	14.0	18.0	16.0	18.5	12.0	15.3
	24	15.0	14.5	15.0	14.0	16.0	14.0	15.0
	25	14.0	14.0	14.0	14.0	14.5	14.0	14.3
	26	13.5	13.5	16.5	16.0	17.5	13.0	15.3
	27	15.0	15.0	15.5	15.0	16.0	14.5	15.3
	28	14.0	13.0	14.0	13.5	15.0	13.0	14.0
	29	13.5	13.5	15.0	14.5	15.5	13.0	14.3
	30	14.0	14.5	20.5	20.0	22.0	14.0	18.0
50 cm	Jul 1	18.0	18.0	21.5	21.0	21.5	17.0	19.3
	2	19.5	19.5	22.0	20.0	23.0	18.5	20.8
	3	20.0	19.5	24.5	21.5	24.5	19.0	21.8
	4	19.0	19.5	23.0	22.0	23.0	18.0	20.5
	5	20.5	21.0	27.0	20.0	27.0	19.5	23.3
	6	20.0	19.5	24.5	23.5	24.5	19.5	22.0
	7	22.0	22.5	26.0	24.0	26.0	21.5	23.8
	8	21.5	21.0	22.5	22.0	24.0	20.0	22.0
	9	20.5	20.5	23.0	22.0	23.0	19.0	21.0
	10	21.0	20.5	23.5	23.0	24.0	20.0	22.0
	11	20.0	21.0	25.0	22.0	26.0	19.5	22.8
	12	20.5	21.0	21.5	21.0	22.0	20.0	21.0
	13	19.5	19.5	20.5	20.0	21.0	19.0	20.0
	14	18.5	18.5	20.0	19.0	20.5	17.5	19.0

Appendix 2. Inshore water temperatures measured by continuous-recording thermometer, Dauphin Lake, 1985.

Depth	Date	Temperatures (°C) 0600 (h)	1200 (h)	1800 (h)	2400 (h)	Max.	Min.	Mean
	15	17.0	18.5	24.0	19.0	24.0	16.5	20.3
	16	18.0	18.0	20.5	20.0	21.0	18.0	19.5
	17	19.0	19.5	21.5	19.5	21.5	18.0	19.8
	18	19.0	18.5	18.5	18.5	19.5	18.5	19.0
	19	16.5	17.0	19.5	18.5	19.5	16.0	17.8
	20	16.5	17.0	21.0	20.0	22.0	16.0	19.0
	21	18.0	18.0	M	M	20.0	17.0	18.5
	31	M	19.5	23.5	22.5	24.0	19.0	21.5
50 cm	Aug 1	21.0	20.5	21.0	21.0	22.5	19.5	21.0
	2	20.5	20.0	23.5	22.5	23.5	19.0	21.3
	3	22.0	21.0	21.5	21.5	22.5	21.0	21.8
	4	21.0	21.0	21.0	21.0	21.5	21.0	21.3
	5	20.5	20.5	24.0	22.0	24.5	19.5	22.0
	6	21.0	20.0	22.5	21.5	22.5	19.5	21.0
	7	20.0	18.5	22.0	21.5	22.0	18.0	20.0
	8	20.0	19.5	20.0	20.5	21.5	19.5	20.5
	9	19.5	18.5	18.5	19.0	20.0	18.0	19.0
	10	19.0	17.5	20.5	20.5	21.0	17.0	19.0
	11	19.5	17.5	19.5	19.5	20.5	17.5	19.0
	12	19.0	19.0	19.0	18.5	19.5	18.5	19.0
	13	18.5	18.5	18.5	18.5	18.5	18.0	18.3
	14	18.0	17.0	18.0	18.5	18.5	17.0	17.8
	15	18.5	17.0	18.5	19.0	19.0	17.0	18.0
	16	19.0	18.0	18.5	18.5	19.0	18.0	18.5
	17	18.5	18.0	18.0	18.5	18.5	18.0	18.3
	18	18.5	17.5	18.0	18.5	18.5	17.5	18.0
	19	18.5	17.0	18.5	18.5	18.5	16.5	17.5
	20	18.5	16.5	18.5	18.5	18.5	16.5	17.5
	21	18.5	17.0	18.5	18.5	18.5	17.0	17.8
	22	18.5	18.0	18.0	18.5	18.5	18.0	18.3
	23	18.5	18.5	18.5	18.5	18.5	18.0	18.3
	24	18.5	17.5	21.5	19.5	22.0	17.5	19.8
	25	19.5	18.5	20.0	19.5	20.0	18.5	19.3
	26	19.5	18.0	19.5	19.0	19.5	18.0	18.8
	27	19.0	17.5	19.5	19.5	19.5	17.5	18.5
	28	19.0	18.0	19.0	19.5	19.5	18.0	18.8
	29	18.5	18.0	18.5	19.5	19.5	18.0	18.8
	30	19.0	17.5	20.0	19.5	20.0	17.5	18.8
	31	19.5	17.5	19.0	19.0	19.5	17.5	18.5
50cm	Sept 1	19.0	17.0	19.5	19.5	19.5	17.0	18.3
	2	19.0	18.5	18.5	18.5	19.0	18.5	18.8
	3	18.5	18.0	20.0	19.5	20.0	17.5	18.8
	4	19.0	18.5	18.5	19.0	19.0	18.5	18.8

Appendix 2. Inshore water temperatures measured by continuous-recording thermometer, Dauphin Lake, 1985.

Depth	Date	Temperatures (°C) 0600 (h)	1200 (h)	1800 (h)	2400 (h)	Max.	Min.	Mean
	5	19.0	18.5	18.0	18.5	19.0	18.5	18.8
	6	18.5	16.5	18.0	18.5	18.5	16.5	17.5
	7	18.5	18.5	18.5	18.5	18.5	18.5	18.5
	8	18.5	16.5	17.5	18.5	18.5	16.0	17.3
	9	18.5	18.0	17.5	18.0	18.5	17.5	18.0
	10	18.5	17.0	17.5	18.5	18.5	16.5	17.5
	11	18.5	16.5	17.5	18.0	18.5	16.5	17.5
	12	18.5	16.5	17.5	18.0	18.5	16.0	17.3
	13	18.0	17.5	M	M	18.0	17.5	17.8
100cm	May 22	M	M	M	17.0	17.5	17.0	17.3
	23	16.0	16.0	18.0	18.0	18.5	15.5	17.0
	24	16.5	16.0	16.0	15.5	18.0	15.5	16.8
	25	15.5	15.0	16.5	16.5	16.5	15.0	15.8
	26	16.0	16.0	17.0	16.5	17.0	15.5	16.3
	27	15.5	15.5	17.5	16.5	18.0	15.5	16.8
	28	15.5	15.5	18.0	17.5	18.0	15.5	16.8
	29	17.0	17.0	18.0	17.0	18.5	17.0	17.8
	30	17.0	17.0	17.0	16.0	17.0	16.0	16.5
	31	15.0	14.5	15.0	13.5	16.0	13.5	14.8
100cm	Jun 1	12.0	11.5	12.0	11.5	13.5	11.5	12.5
	2	11.0	11.0	14.0	11.5	14.0	10.5	12.3
	3	11.5	11.5	12.0	11.0	12.0	11.0	12.5
	4	10.5	10.0	11.0	11.0	11.5	10.0	10.8
	5	11.0	11.5	16.0	15.5	16.5	10.5	13.5
	6	14.5	14.5	16.5	16.5	16.5	14.0	15.3
	7	14.5	14.5	20.0	16.5	20.5	14.0	17.3
	8	17.0	16.0	M	M	17.0	M	16.5
	12	M	M	M	17.5	M	M	M
	13	M	15.5	M	17.0	17.5	15.5	16.5
	14	16.0	16.0	17.5	17.0	17.5	16.0	16.8
	15	16.5	16.5	17.0	18.0	20.0	16.0	18.0
	16	18.0	17.5	17.5	17.0	18.0	17.0	17.5
	17	16.0	16.0	16.0	16.0	17.0	15.5	16.3
	18	15.5	15.5	17.0	17.0	17.5	15.0	16.3
	19	16.5	M	M	M	M	M	M
	20	M	M	20.5	21.0	M	M	M
	21	19.5	18.5	18.5	17.5	21.0	17.5	18.8
	22	15.5	14.5	14.5	14.5	17.5	14.5	16.0
	23	14.0	13.5	17.5	15.5	17.5	13.0	15.3
	24	15.0	15.0	15.0	14.5	15.5	14.5	15.0
	25	14.5	14.0	14.5	14.5	14.5	14.0	14.3

Appendix 2. Inshore water temperatures measured by continuous-recording thermometer, Dauphin Lake, 1985.

Depth	Date	Temperatures (°C) 0600 (h)	1200 (h)	1800 (h)	2400 (h)	Max.	Min.	Mean
	26	14.5	14.5	16.0	16.0	16.0	14.0	15.0
	27	15.5	15.5	15.5	15.0	16.0	15.0	15.5
	28	14.5	14.0	14.0	14.0	15.0	14.0	14.5
	29	14.0	14.0	14.5	14.5	14.5	13.5	14.0
	30	14.5	15.0	20.0	19.5	20.0	14.0	17.0
100cm	Jul 1	18.0	13.0	19.5	19.0	19.5	12.0	15.8
	2	18.5	19.0	18.5	19.0	20.5	18.0	19.3
	3	19.0	21.0	21.5	20.5	23.0	19.0	21.0
	4	19.0	19.5	21.0	21.0	21.5	19.0	20.3
	5	20.0	20.0	19.5	19.5	21.0	19.5	20.3
	6	19.5	19.5	22.5	21.5	22.5	19.5	21.0
	7	21.5	22.0	23.5	23.0	23.5	21.0	22.3
	8	22.0	22.0	22.0	21.5	23.0	21.5	22.3
	9	20.0	20.0	21.5	21.5	21.5	20.0	20.8
	10	20.5	20.0	22.0	21.5	22.5	19.5	21.0
	11	20.5	19.5	22.5	20.5	23.0	19.5	22.3
	12	20.0	20.5	20.5	20.5	21.0	19.5	20.3
	13	20.0	19.5	20.0	20.0	20.0	19.5	19.8
	14	19.0	18.5	20.0	19.0	20.0	18.5	19.3
	15	18.0	18.0	18.5	18.5	19.5	17.0	18.3
	16	18.5	18.0	19.0	19.5	19.5	18.0	18.8
	17	19.0	19.0	19.0	19.0	20.5	18.5	19.5
	18	18.5	18.5	18.5	18.5	19.0	18.0	18.5
	19	17.5	17.0	18.5	18.5	18.5	16.5	17.5
	20	17.5	17.0	20.0	19.5	20.5	16.5	18.5
	21	18.5	18.0	20.5	19.5	20.5	17.5	19.0
	22	18.5	18.5	20.0	20.0	20.0	18.0	19.0
	23	19.0	19.5	20.0	19.5	20.0	19.0	19.5
	24	19.0	19.0	20.5	19.5	20.5	18.0	19.3
	25	18.5	18.5	20.5	20.0	20.0	18.5	19.3
	26	19.0	18.5	20.5	20.5	21.0	18.0	19.5
	27	19.0	18.5	20.0	19.0	20.5	18.5	19.5
	28	18.5	17.5	18.5	18.5	19.0	17.5	18.3
	29	17.5	17.0	19.0	18.0	20.0	16.5	18.3
	30	18.0	18.0	20.5	20.0	20.5	17.5	19.0
	31	19.5	19.5	22.5	22.0	23.0	18.5	20.8
100cm	Aug 1	21.0	20.5	21.0	20.5	22.0	20.0	21.0
	2	20.0	20.0	22.5	22.0	22.5	19.5	21.0
	3	21.0	21.0	21.5	21.5	22.0	21.0	21.5
	4	21.0	21.0	21.0	21.0	21.5	21.0	21.3
	5	20.5	20.5	24.5	21.5	24.5	20.0	22.3
	6	21.0	20.5	22.0	21.5	22.5	20.0	21.3
	7	19.5	19.0	21.5	21.0	21.5	18.5	20.0
	8	20.0	19.5	20.0	20.0	21.0	19.5	20.3

Appendix 2. Inshore water temperatures measured by continuous-recording thermometer, Dauphin Lake, 1985.

Depth	Date	Temperatures (°C) 0600 (h)	1200 (h)	1800 (h)	2400 (h)	Max.	Min.	Mean
	9	18.5	18.0	18.0	17.5	20.0	17.5	18.8
	10	16.5	16.0	19.5	17.5	19.5	15.5	17.5
	11	17.0	16.0	17.5	17.5	17.5	16.0	16.8
	12	17.0	16.5	16.5	16.0	17.5	16.0	16.8
	13	16.0	15.5	15.5	15.0	16.5	15.0	15.8
	14	14.5	14.0	16.0	15.5	16.0	14.0	15.0
	15	15.0	15.5	16.5	16.5	16.5	14.5	15.5
	16	16.0	15.5	15.5	15.5	16.5	15.5	16.0
	17	15.0	15.0	15.0	14.5	15.5	14.5	15.0
	18	14.0	14.0	15.0	15.0	15.0	13.5	14.3
	19	14.5	14.0	15.0	14.5	15.0	13.5	14.3
	20	14.0	14.0	16.0	15.5	16.0	13.0	14.5
	21	15.0	15.0	16.0	16.0	16.0	14.5	15.3
	22	16.0	16.0	16.5	16.5	17.0	15.5	16.3
	23	16.5	16.0	16.0	16.0	16.5	16.0	16.3
	24	16.0	16.5	16.0	16.5	17.0	15.5	16.3
	25	17.5	18.0	19.0	18.0	19.0	16.5	17.8
	26	18.0	17.5	19.0	17.5	19.0	17.0	18.0
	27	16.5	16.0	18.0	17.5	18.0	15.5	16.8
	28	16.5	16.0	17.5	17.0	17.5	16.0	16.8
	29	16.5	16.0	17.0	16.5	17.0	15.5	16.3
	30	16.0	15.5	18.0	18.0	18.5	15.5	17.0
	31	18.0	17.5	18.0	17.0	18.0	17.0	17.5
100cm	Sep 1	16.5	15.5	18.0	17.5	18.0	15.5	16.8
	2	17.0	16.5	16.5	16.0	17.5	16.0	16.8
	3	16.0	15.5	17.5	17.5	18.0	15.5	16.8
	4	16.5	16.0	16.0	16.0	17.5	16.0	16.8
	5	15.0	14.5	14.5	14.5	16.0	14.5	15.3
	6	14.0	13.0	14.5	14.0	14.5	13.0	13.8
	7	13.5	13.0	13.0	12.5	14.0	12.5	13.8
	8	12.0	11.5	12.5	13.0	13.0	11.5	12.3
	9	12.5	12.5	14.0	13.5	14.0	12.5	13.3
	10	13.0	12.5	15.0	13.5	15.0	12.5	13.3
	11	13.5	12.5	14.0	14.0	14.5	12.5	13.5
	12	13.5	13.0	14.5	14.0	14.5	12.5	13.5
	13	13.5	13.5	14.5	14.5	15.0	13.5	14.3
	14	14.0	14.0	15.0	15.0	15.0	13.5	14.3
	15	14.5	15.0	16.0	16.5	16.5	14.5	15.5
	16	16.0	14.5	15.5	16.0	16.5	14.5	15.5
	17	15.0	15.0	15.5	14.5	16.0	14.5	15.3
	18	13.5	13.0	13.0	12.5	14.5	12.5	13.5
	19	12.5	12.0	11.5	11.0	12.5	11.0	11.8
	20	10.0	9.5	9.5	9.0	11.0	9.0	10.0
	21	8.5	8.0	7.5	8.0	9.0	7.5	8.3
	22	8.5	8.0	8.0	8.0	8.5	8.0	8.3

Appendix 2. Inshore water temperatures measured by continuous-recording thermometer, Dauphin Lake, 1985.

Depth	Date	Temperatures (°C) 0600 (h)	1200 (h)	1800 (h)	2400 (h)	Max.	Min.	Mean
	23	7.5	7.0	7.5	7.0	8.0	6.5	7.3
	28	M	M	M	5.0	5.0	5.0	5.0
	29	5.0	4.5	5.5	6.0	6.0	4.5	5.3
	30	5.0	4.5	6.5	7.0	7.0	4.5	5.8
100cm	Oct 1	6.5	5.0	6.5	6.0	7.0	5.0	6.0
	2	6.0	6.0	6.5	6.5	6.5	6.0	6.3
	3	6.0	6.0	7.0	7.0	7.0	6.0	6.5
	4	7.0	6.5	6.5	6.5	7.0	6.5	6.8
	5	6.0	5.5	6.5	6.5	6.5	5.5	6.0
	6	6.0	6.0	6.5	6.5	6.5	6.0	6.3
	7	6.0	6.0	6.0	5.5	6.5	5.5	6.0
	8	5.0	4.5	4.0	3.5	5.5	3.5	4.5
	9	3.0	2.0	3.0	3.0	3.5	2.0	2.8
	10	2.5	1.5	2.5	3.0	3.0	1.5	2.3
	11	3.0	2.5	3.5	4.0	4.0	2.0	3.0
	12	4.0	4.5	5.5	5.0	5.5	4.0	4.8
	13	4.5	4.5	M	M	5.0	4.0	4.5

M = missing data

Appendix 3. Offshore surface water temperatures and secchi depths measured at various locations, Dauphin Lake, 1984 and 1985.

1984				1985			
Date	Location	Water Temp. (°C)	Secchi Depth (cm)	Date	Location	Water Temp. (°C)	Secchi Depth (cm)
30-May-84	14	16.0	23	16-May-85	21	18.0	25
30-May-84	21	18.0	21	16-May-85	17	18.0	15
30-May-84	20	16.5	21	16-May-85	17	18.0	32
30-May-84	20	17.0	23	24-May-85	17	18.0	20
30-May-84	19	18.0	21	24-May-85	21	17.5	25
30-May-84	18	17.0	22	05-Jun-85	20	16.0	M
30-May-84	21	17.0	20	06-Jun-85	13	14.0	26
30-May-84	17	18.0	30	06-Jun-85	20	13.0	26
30-May-84	16	19.0	39	06-Jun-85	19	14.0	26
30-May-84	15	21.0	28	06-Jun-85	18	14.0	23
30-May-84	21	23.0	23	06-Jun-85	17	15.0	26
31-May-84	4	17.0	22	11-Jun-85	21	14.0	17
31-May-84	3	17.0	25	11-Jun-85	16	14.0	18
31-May-84	12	16.5	22	11-Jun-85	15	14.0	22
31-May-84	2	16.5	30	11-Jun-85	14	15.0	22
31-May-84	1	16.0	34	11-Jun-85	12	17.0	25
31-May-84	11	17.0	25	11-Jun-85	5	16.0	24
31-May-84	10	18.0	29	11-Jun-85	7	16.0	19
31-May-84	9	19.0	27	11-Jun-85	8	16.0	26
31-May-84	8	19.0	30	11-Jun-85	9	16.0	25
31-May-84	7	21.0	25	11-Jun-85	10	16.5	30
31-May-84	6	19.0	25	11-Jun-85	1	16.5	27
31-May-84	5	19.0	25	11-Jun-85	11	16.5	25
31-May-84	12	18.0	20	11-Jun-85	3	16.0	26
01-Jun-84	19	15.0	23	11-Jun-85	4	16.5	30
01-Jun-84	18	15.0	25	25-Jun-85	13	14.5	20
01-Jun-84	21	25.0	25	25-Jun-85	20	14.0	20
03-Jun-84	5	14.0	M	25-Jun-85	19	14.5	20
03-Jun-84	5	14.5	M	25-Jun-85	18	14.0	20
03-Jun-84	6	14.5	M	25-Jun-85	21	14.0	20
04-Jun-84	13	16.0	M	25-Jun-85	17	15.0	20
04-Jun-84	20	16.0	M	25-Jun-85	16	14.5	25
04-Jun-84	20	16.0	M	26-Jun-85	14	15.0	22
04-Jun-84	19	16.0	M	26-Jun-85	15	14.0	17
04-Jun-84	18	16.0	M	26-Jun-85	4	15.0	25
04-Jun-84	21	17.0	M	26-Jun-85	3	14.5	23
04-Jun-84	17	17.0	M	26-Jun-85	12	15.0	20
04-Jun-84	16	17.0	M	26-Jun-85	11	15.0	27
04-Jun-84	15	17.0	M	26-Jun-85	1	16.0	35
04-Jun-84	21	16.0	M	26-Jun-85	10	16.0	26
04-Jun-84	14	17.0	M	26-Jun-85	9	16.0	30
05-Jun-84	4	16.0	M	26-Jun-85	8	16.0	26
05-Jun-84	12	16.0	M	26-Jun-85	7	16.0	24
05-Jun-84	5	16.0	M	26-Jun-85	5	16.0	25
05-Jun-84	6	16.0	M	08-Jul-85	4	23.0	15

Appendix 3. Offshore surface water temperatures and secchi depths measured at various locations, Dauphin Lake, 1984 and 1985.

1984				1985			
Date	Location	Water Temp. (°C)	Secchi Depth (cm)	Date	Location	Water Temp. (°C)	Secchi Depth (cm)
05-Jun-84	7	16.0	M	08-Jul-85	3	23.0	17
05-Jun-84	11	17.0	M	08-Jul-85	12	22.0	20
05-Jun-84	8	16.0	M	08-Jul-85	11	22.0	25
05-Jun-84	9	16.0	M	08-Jul-85	1	23.0	32
05-Jun-84	10	17.0	M	08-Jul-85	10	23.0	30
05-Jun-84	1	17.0	M	08-Jul-85	9	23.0	35
05-Jun-84	2	17.0	M	08-Jul-85	8	23.0	40
05-Jun-84	3	17.0	M	08-Jul-85	7	23.0	37
05-Jun-84	12	15.0	M	08-Jul-85	5	23.0	30
06-Jun-84	13	16.0	34	10-Jul-85	14	22.0	22
06-Jun-84	20	16.0	20	10-Jul-85	21	21.0	24
06-Jun-84	20	16.0	15	10-Jul-85	15	21.0	23
06-Jun-84	19	16.0	20	10-Jul-85	16	22.0	21
06-Jun-84	18	16.0	19	10-Jul-85	17	22.0	24
06-Jun-84	21	16.0	10	10-Jul-85	18	22.0	27
06-Jun-84	17	16.0	12	10-Jul-85	19	22.0	22
06-Jun-84	16	16.0	M	10-Jul-85	20	22.0	24
06-Jun-84	15	16.0	M	10-Jul-85	13	22.0	22
06-Jun-84	21	16.0	22	11-Jul-85	13	20.0	M
06-Jun-84	14	16.0	22	11-Jul-85	13	20.0	M
11-Jun-84	4	21.0	20	24-Jul-85	4	19.5	25
11-Jun-84	3	19.0	20	24-Jul-85	3	19.5	20
11-Jun-84	12	18.0	22	24-Jul-85	12	19.0	25
11-Jun-84	2	18.0	18	24-Jul-85	11	19.0	30
11-Jun-84	1	20.0	24	24-Jul-85	1	20.0	38
11-Jun-84	11	18.0	18	24-Jul-85	10	20.0	34
11-Jun-84	10	17.0	28	24-Jul-85	9	20.0	45
11-Jun-84	9	16.0	30	24-Jul-85	8	20.0	40
11-Jun-84	8	16.0	30	24-Jul-85	7	20.0	20
11-Jun-84	7	16.0	33	24-Jul-85	5	20.0	20
11-Jun-84	6	17.0	25	25-Jul-85	14	20.0	20
11-Jun-84	5	16.0	23	25-Jul-85	15	21.0	20
11-Jun-84	12	17.5	20	25-Jul-85	16	21.0	22
12-Jun-84	13	16.0	20	25-Jul-85	17	21.0	24
12-Jun-84	20	16.0	15	25-Jul-85	21	21.0	28
12-Jun-84	20	16.0	15	25-Jul-85	18	21.0	28
12-Jun-84	19	16.0	15	25-Jul-85	19	20.0	26
12-Jun-84	18	15.5	15	25-Jul-85	20	20.0	33
12-Jun-84	21	16.0	20	25-Jul-85	13	20.0	M
12-Jun-84	17	16.0	15	07-Aug-85	13	21.5	14
12-Jun-84	17	16.0	15	07-Aug-85	13	21.5	14
12-Jun-84	16	16.0	M	07-Aug-85	13	21.5	14
12-Jun-84	15	16.0	M	07-Aug-85	13	21.5	14
12-Jun-84	14	16.0	M	07-Aug-85	13	21.5	14
13-Jun-84	4	16.0	15	08-Aug-85	13	21.5	14

Appendix 3. Offshore surface water temperatures and secchi depths measured at various locations, Dauphin Lake, 1984 and 1985.

1984				1985			
Date	Location	Water Temp. (°C)	Secchi Depth (cm)	Date	Location	Water Temp. (°C)	Secchi Depth (cm)
13-Jun-84	3	17.0	15	08-Aug-85	13	19.5	24
13-Jun-84	2	17.0	15	08-Aug-85	13	19.5	24
13-Jun-84	1	16.0	17	08-Aug-85	13	19.5	24
13-Jun-84	11	16.0	18	08-Aug-85	13	19.5	24
13-Jun-84	10	16.0	18	08-Aug-85	13	19.5	24
13-Jun-84	9	16.0	23	08-Aug-85	14	19.5	24
13-Jun-84	8	16.0	23	08-Aug-85	14	19.5	24
13-Jun-84	7	17.0	22	08-Aug-85	13	19.5	23
13-Jun-84	11	17.0	20	20-Aug-85	13	14.0	25
13-Jun-84	12	18.0	22	20-Aug-85	13	14.0	25
13-Jun-84	6	18.0	18	20-Aug-85	13	14.0	25
13-Jun-84	5	17.0	20	20-Aug-85	13	14.0	25
13-Jun-84	12	18.0	18	20-Aug-85	13	14.0	25
14-Jun-84	13	15.0	17	20-Aug-85	13	15.0	25
14-Jun-84	20	15.0	16	20-Aug-85	13	15.0	25
14-Jun-84	20	16.0	15	20-Aug-85	15	16.0	27
14-Jun-84	19	16.0	23	20-Aug-85	16	17.0	27
14-Jun-84	18	17.0	19	20-Aug-85	17	17.0	21
14-Jun-84	21	17.0	18	20-Aug-85	18	17.0	17
14-Jun-84	17	18.0	19	22-Aug-85	13	15.0	33
14-Jun-84	17	18.0	20	22-Aug-85	13	16.0	33
14-Jun-84	16	18.0	20	22-Aug-85	13	16.0	33
14-Jun-84	15	18.0	19	22-Aug-85	13	16.0	33
14-Jun-84	21	17.0	19	22-Aug-85	20	17.0	25
14-Jun-84	14	18.0	20	22-Aug-85	4	17.0	25
15-Jun-84	4	17.0	17	22-Aug-85	3	17.0	25
15-Jun-84	3	17.0	16	22-Aug-85	11	16.5	20
15-Jun-84	2	17.0	14	22-Aug-85	7	17.0	20
15-Jun-84	1	17.0	14	22-Aug-85	5	17.0	15
15-Jun-84	11	16.0	15	22-Aug-85	12	16.0	25
15-Jun-84	10	17.0	17	22-Aug-85	13	16.0	M
15-Jun-84	9	17.0	20	22-Aug-85	20	16.0	M
15-Jun-84	8	17.0	22	28-Sep-85	13	5.0	10
15-Jun-84	11	17.0	20	28-Sep-85	13	5.0	10
15-Jun-84	7	17.0	16	28-Sep-85	13	5.0	10
15-Jun-84	12	18.0	19	28-Sep-85	13	5.0	10
15-Jun-84	6	18.0	19	28-Sep-85	13	5.5	10
15-Jun-84	5	18.0	20	28-Sep-85	13	5.5	10
15-Jun-84	12	18.0	21	28-Sep-85	13	5.5	10
16-Jun-84	13	18.0	20				
16-Jun-84	20	18.0	28				
16-Jun-84	20	19.0	17				
16-Jun-84	19	19.0	29				
16-Jun-84	18	19.0	28				
16-Jun-84	21	19.0	21				

Appendix 3. Offshore surface water temperatures and secchi depths measured at various locations, Dauphin Lake, 1984 and 1985.

1984				1985			
Date	Location	Water Temp. (°C)	Secchi Depth (cm)	Date	Location	Water Temp. (°C)	Secchi Depth (cm)
16-Jun-84	17	20.0	21				
16-Jun-84	17	19.0	23				
16-Jun-84	16	20.0	26				
16-Jun-84	15	20.0	24				
16-Jun-84	21	20.0	25				
16-Jun-84	14	20.0	25				
17-Jun-84	4	18.0	16				
17-Jun-84	3	18.0	21				
17-Jun-84	2	18.0	23				
17-Jun-84	1	19.0	28				
17-Jun-84	11	19.0	29				
17-Jun-84	10	19.0	32				
17-Jun-84	9	19.0	31				
17-Jun-84	8	18.0	35				
17-Jun-84	7	20.0	34				
17-Jun-84	11	19.0	34				
17-Jun-84	12	19.0	41				
17-Jun-84	6	20.0	40				
17-Jun-84	5	20.0	50				
19-Jun-84	4	19.0	21				
19-Jun-84	3	19.0	28				
19-Jun-84	2	19.0	24				
19-Jun-84	1	19.0	M				
19-Jun-84	11	18.0	24				
19-Jun-84	10	19.0	26				
19-Jun-84	9	19.0	42				
19-Jun-84	8	19.0	42				
19-Jun-84	7	19.0	45				
19-Jun-84	12	19.0	40				
19-Jun-84	6	20.0	40				
19-Jun-84	5	20.0	46				
19-Jun-84	12	20.0	33				
20-Jun-84	13	19.0	28				
20-Jun-84	20	19.0	18				
20-Jun-84	20	18.0	22				
20-Jun-84	19	18.0	28				
20-Jun-84	18	18.0	20				
20-Jun-84	21	18.0	24				
20-Jun-84	17	18.0	M				
20-Jun-84	17	18.0	30				
20-Jun-84	16	19.0	30				
20-Jun-84	15	18.0	30				
20-Jun-84	21	18.0	24				
20-Jun-84	14	18.0	26				
21-Jun-84	4	19.5	15				

Appendix 3. Offshore surface water temperatures and secchi depths measured at various locations, Dauphin Lake, 1984 and 1985.

1984				1985			
Date	Location	Water Temp. (°C)	Secchi Depth (cm)	Date	Location	Water Temp. (°C)	Secchi Depth (cm)
21-Jun-84	3	19.5	18				
21-Jun-84	12	19.5	17				
21-Jun-84	2	19.5	15				
21-Jun-84	1	19.5	20				
21-Jun-84	11	19.5	20				
21-Jun-84	10	19.5	21				
21-Jun-84	9	19.5	16				
21-Jun-84	8	19.5	17				
21-Jun-84	7	20.0	15				
10-Jul-84	13	20.0	M				
10-Jul-84	20	20.0	M				
10-Jul-84	19	21.0	M				
10-Jul-84	18	21.5	M				
10-Jul-84	21	22.0	M				
10-Jul-84	17	23.0	M				
10-Jul-84	16	23.0	M				
10-Jul-84	15	22.0	M				
10-Jul-84	14	25.0	M				
12-Jul-84	12	21.0	25				
12-Jul-84	5	21.0	30				
12-Jul-84	6	21.5	40				
12-Jul-84	7	22.5	25				
12-Jul-84	8	21.5	25				
12-Jul-84	9	21.0	50				
12-Jul-84	10	21.5	50				
12-Jul-84	11	22.0	40				
12-Jul-84	1	22.0	40				
12-Jul-84	2	22.0	30				
12-Jul-84	3	22.0	25				
12-Jul-84	4	22.0	20				
27-Jul-84	14	20.0	35				
27-Jul-84	15	21.5	35				
27-Jul-84	16	21.5	35				
27-Jul-84	17	22.5	50				
27-Jul-84	21	22.5	50				
27-Jul-84	18	22.5	55				
27-Jul-84	19	23.0	50				
27-Jul-84	20	23.0	40				
27-Jul-84	13	23.0	35				
10-Aug-84	20	21.0	20				
10-Aug-84	19	20.5	20				
10-Aug-84	18	20.5	20				
10-Aug-84	17	20.5	30				
10-Aug-84	16	21.0	35				
10-Aug-84	21	21.0	20				

Appendix 3. Offshore surface water temperatures and secchi depths measured at various locations, Dauphin Lake, 1984 and 1985.

1984				1985			
Date	Location	Water Temp. (°C)	Secchi Depth (cm)	Date	Location	Water Temp. (°C)	Secchi Depth (cm)
10-Aug-84	15	21.0	35				
10-Aug-84	14	21.0	35				
10-Aug-84	13	21.0	30				
12-Aug-84	12	M	25				
12-Aug-84	5	M	25				
12-Aug-84	6	M	25				
12-Aug-84	7	M	35				
12-Aug-84	9	M	35				
12-Aug-84	10	M	35				
12-Aug-84	11	M	25				
12-Aug-84	1	M	30				
12-Aug-84	2	M	30				
12-Aug-84	3	M	25				
12-Aug-84	4	M	25				

M = missing data

Appendix 4. Inshore surface water temperatures and air temperatures at various locations in Dauphin Lake, 1985.

Date	Location	Water Temp. (°C)	Air Temp. (°C)	Date	Location	Water Temp. (°C)	Air Temp. (°C)
17-5-85	F	M	16.0	18-7-85	C	22.0	19.5
17-5-85	G	M	16.0	18-7-85	D	20.0	18.0
17-5-85	E	M	17.0	29-7-85	G	20.0	18.0
27-5-85	B	20.0	18.0	29-7-85	H	24.0	24.5
27-5-85	A	20.0	16.0	29-7-85	A	21.0	24.0
27-5-85	H	20.0	17.0	29-7-85	B	23.0	24.0
28-5-85	C	20.0	21.0	30-7-85	D	17.5	19.0
28-5-85	D	20.0	21.0	30-7-85	C	21.0	21.0
30-5-85	E	17.0	14.0	30-7-85	F	20.5	19.0
30-5-85	G	18.5	14.5	30-7-85	E	24.5	24.0
30-5-85	F	17.5	15.0	30-7-85	E	19.0	14.5
18-6-85	B	16.0	15.0	13-8-85	E	14.0	14.0
19-6-85	A	16.5	18.5	14-8-85	E	13.0	14.0
19-6-85	H	17.5	18.5	14-8-85	C	14.0	16.0
19-6-85	G	18.0	20.0	14-8-85	E	15.0	17.0
19-6-85	C	20.5	22.0	14-8-85	D	17.0	15.5
19-6-85	D	18.0	22.0	14-8-85	E	15.0	17.0
19-6-85	F	24.0	17.0	14-8-85	E	17.0	16.0
20-6-85	E	18.5	16.5	15-8-85	E	15.0	10.0
2-7-85	B	19.0	21.0	15-8-85	B	17.0	14.5
2-7-85	A	21.5	23.0	15-8-85	G	17.0	20.0
2-7-85	H	23.5	21.5	27-8-85	B	18.0	17.0
2-7-85	G	23.0	23.0	27-8-85	A	18.0	17.0
3-7-85	C	22.0	20.0	27-8-85	H	19.0	18.0
3-7-85	D	20.0	23.0	27-8-85	G	19.0	18.0
3-7-85	F	25.0	23.0	28-8-85	C	15.5	15.5
3-7-85	E	23.5	23.0	28-8-85	D	16.5	15.0
15-7-85	F	22.0	24.5	29-8-85	F	16.0	15.0
15-7-85	E	20.5	21.0	29-8-85	E	16.5	15.0
17-7-85	G	22.0	21.0	28-9-85	E	6.0	5.0
17-7-85	H	23.0	23.5	29-9-85	G	6.0	6.0
17-7-85	A	22.5	22.0	29-9-85	F	6.0	7.0
17-7-85	B	24.0	22.5	29-9-85	C	6.0	6.5

M = missing data